THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1590.] LONDON, OCTOBER 31, 1893. [45TH YEAR. PRICE 6d.

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1¼ to 12 IN. BORE.

THOMAS ALLAN & SONS,

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SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

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Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

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Lanemark Coal Co.,

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LANEMARK CANNEL

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THE "C" BURNER.

NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

Consumes
3¾ cubic feet per hour.

Gives a light of
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Brilliant Light.

Perfectly Steady and
Noiseless.

Smokeless.

Reduced Heat.

The Ordinary Burner, with Special Globes, is suitable for Lighting Private Houses, Public Houses, Restaurants, Shops, &c.

Special Lamps constructed for Outside Lighting and Street Lighting; and Large Clusters of Lights made for Lighting Halls and large Areas from one centre.

Can be attached to any Gas-Fittings.

THE TRIUMPH OF GAS OVER ELECTRIC LIGHT.

Taking Gas at 3s. per 1000 cubic feet and Electric Light at 8d. per Board of Trade unit, the "C" Burner will produce an equal amount of light at **One-eighth the cost of Electric Light.** This cannot be disproved.

Substantial and Pushing Sole Agents wanted in each Town using Gas.

For Terms and Particulars, apply to the Manager of

THE INCANDESCENT GAS-LIGHT COMPANY, Ltd.,

14, PALMER STREET, WESTMINSTER, LONDON.

Near St. James's Park Station.

CASH PREPAYMENT METERS.

THE "POSITIVE" PREPAYMENT-SLOT-METER.

Noted for Strength and Simplicity of Construction.

Used by many Corporations and Gas Companies.

Material and Workmanship of the best.

Prices and full Particulars on application.

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This is a first-class Scotch Cannel, from which the following results have been obtained:—

	Gas per Ton in Cubic Feet.	Illuminating Power in Standard Candles.
From LABORATORY TEST	13,215	37·56
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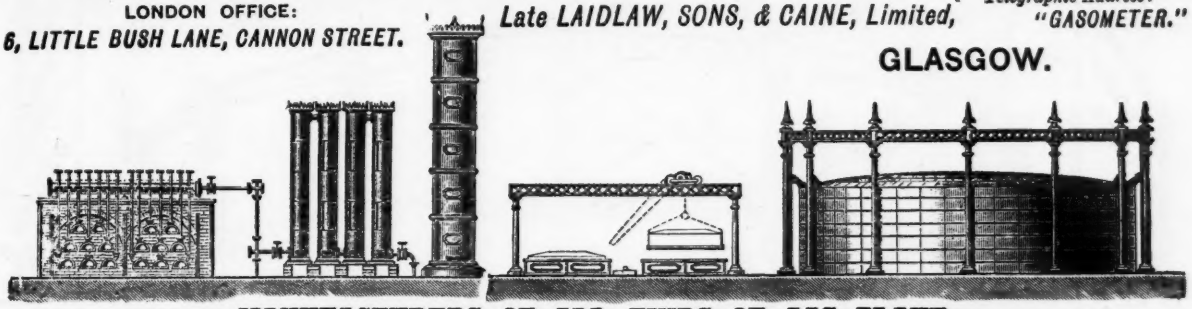

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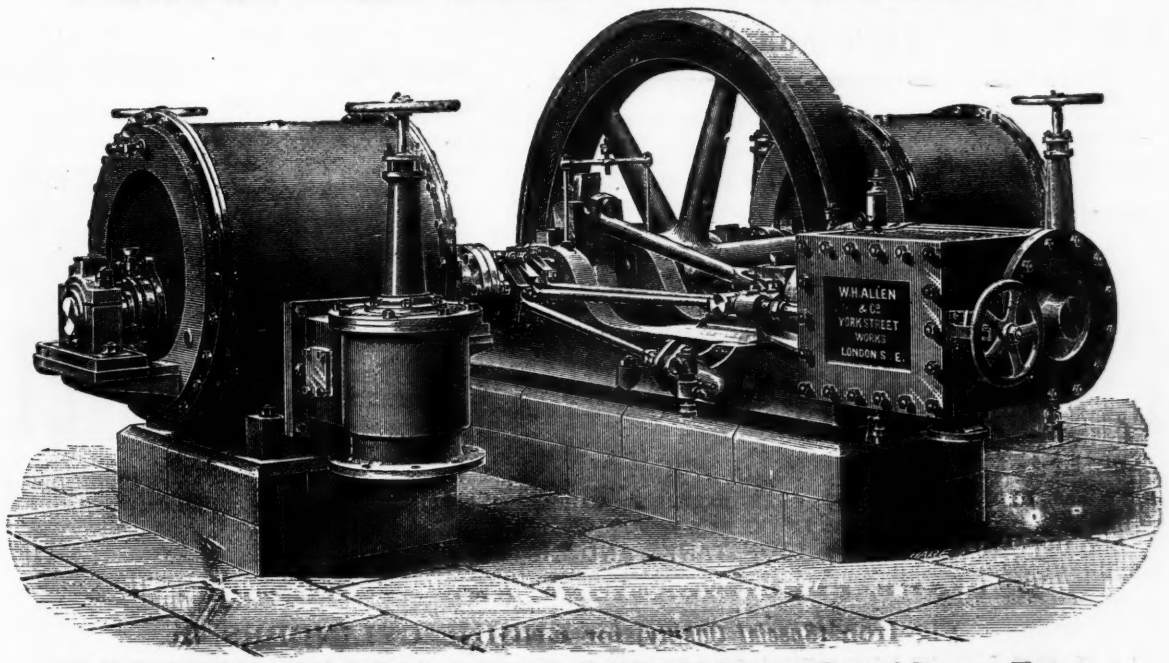

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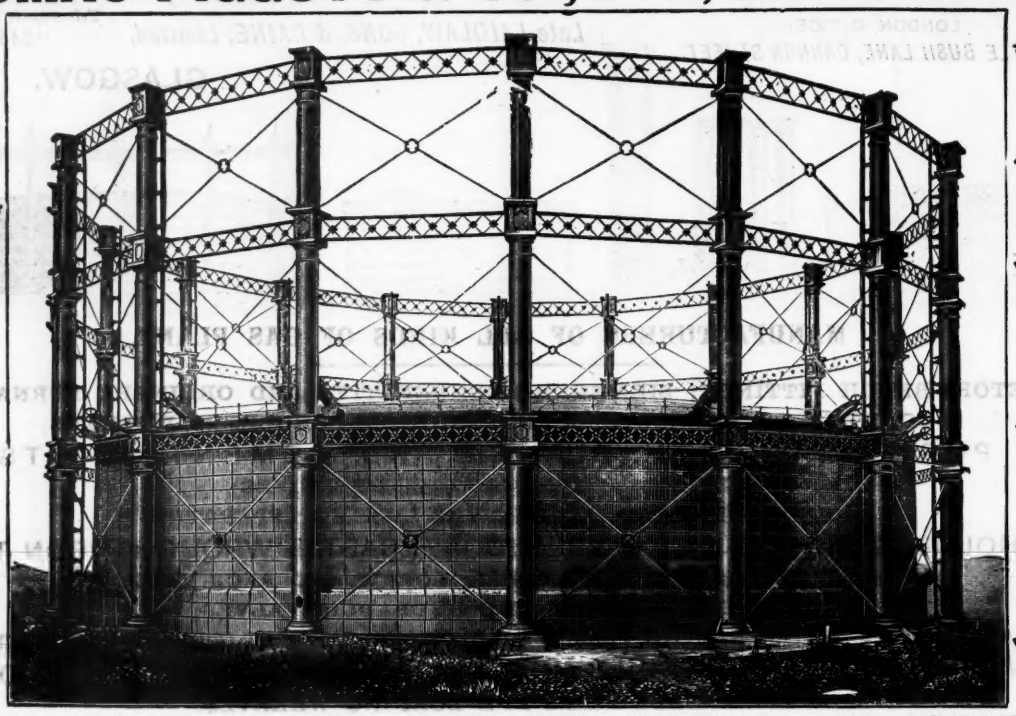

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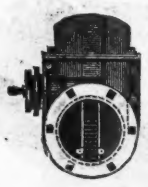

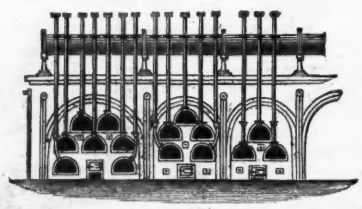

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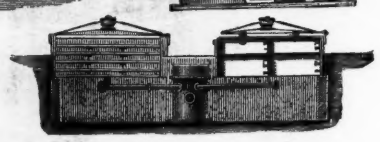

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Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

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furnish Plans, Estimates, and Specifications for SINKING BOREHOLES *and* WELLS; *Erecting* RESERVOIRS, FILTER-BEDS, *and* GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,
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FLOOR-WARMING GAS-STOVES.

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Wrought-Iron

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WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF WARNER'S PATENT MARKET GAS STAND-PIPE.
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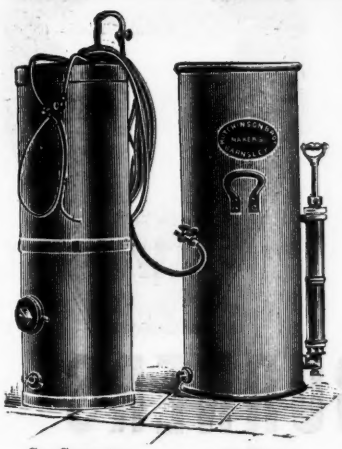
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IMPROVED LEAD-BURNING APPARATUS.

HUTCHINSON BROS.,
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SPECIALITY.
LEAD WORK FOR SULPHATE OF AMMONIA PLANTS,
BEST QUALITY OF MATERIAL AND WORKMANSHIP.
SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing.
ACID TANKS, ELEVATORS, AND COCKS. LIQUOR AND LIME PUMPS OR INJECTORS.
Liquor-Cocks, Gauge Fittings, and Safety-Valves in Cast Iron.
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LEAD BURNERS SENT OUT TO REPAIRS.
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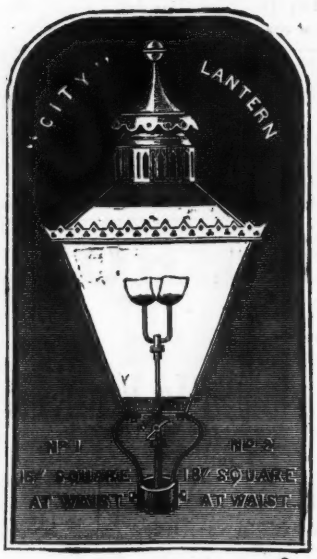
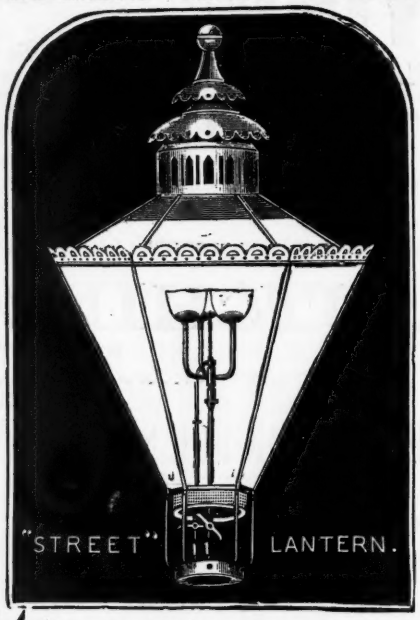
From 30 to 1100 Candle Power.

They are suitable for Gas of every Candle Power.

ALL OUR LANTERNS ARE MADE OF COPPER.



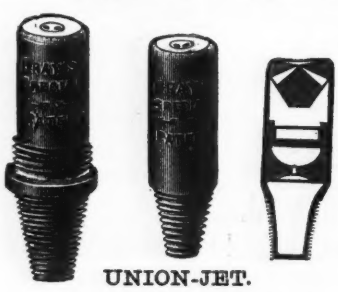


BRAY'S "SPECIAL" BURNERS

Are the best in the Market for general use, and are very moderate in price.

It is not unusual to see the ordinary Burner yielding less than half the light that Bray's "SPECIAL" would yield with the same consumption of Gas.

Gas Managers should try them on consumers' fittings; and they would see at once how to compete more effectively with the Electric Light.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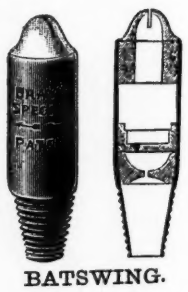
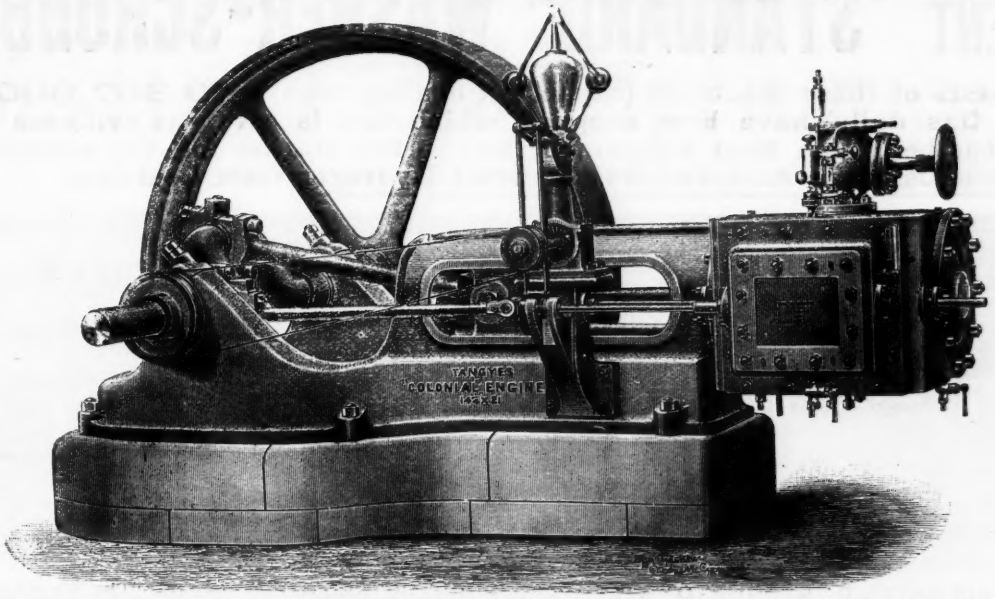

BATSWING.

GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

TANGYES'
"COLONIAL" STEAM-ENGINE

Constructed for Steam Pressures up to 100 lbs. per square inch.



Tangyes' "Colonial" Steam-Engine, with the TANGYE-JOHNSON PATENT AUTOMATIC CUT-OFF GEAR. From a Photograph of the 14½ in. by 21 in. size.

PRICES QUOTED ON RECEIPT OF THE NECESSARY DATA.

TANGYES LIMITED, Cornwall Works, BIRMINGHAM.

AND LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, BILBAO, ROTTERDAM, AND CALCUTTA.

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(YEADON AND ADGIE'S PATENTS)

POSSESS THE FOLLOWING ADVANTAGES OVER ALL OTHERS:—

1. Occupy only one-fourth the space of ordinary Carbonizing Plant.
2. Continuous Automatic process; Gas produced in 12½ minutes.
3. Produce 25 per cent. more Gas per Ton of Coal carbonized.
4. Richer Gas of 15 per cent. additional Illuminating Power.
5. Utilize the smallest size, therefore the lowest price, Coal.
6. Proportionate increase from large Coal when broken as for Stoking-Machines.
7. Enrichment of Gas by Cannel Coal, Oils, &c., rendered unnecessary.
8. No deposit of Carbon in Retorts, or choked Ascension-Pipes.
9. Fogs conquered by the production of Gaslight on five hours' notice.
10. 25 per cent. of Lime saved in the process of Purification.
11. Retorts can be used for Revivifying Spent Lime in 20 minutes.
12. Revivify Spent Oxide for the recovery of Sulphur Compounds.
13. Sunday Ordinary Labour and Nightwork reduced 75 per cent.
14. Overwork and Overtime abolished; also Casual and Foreign Labour.

For Articles on and descriptive of the above Apparatus, see *Journal of Gas Lighting* for Dec. 13, 1892; March 7, April 25, May 2, and May 16, 1893. Also, the *Gas World*, Jan. 21 and May 6, 1893.

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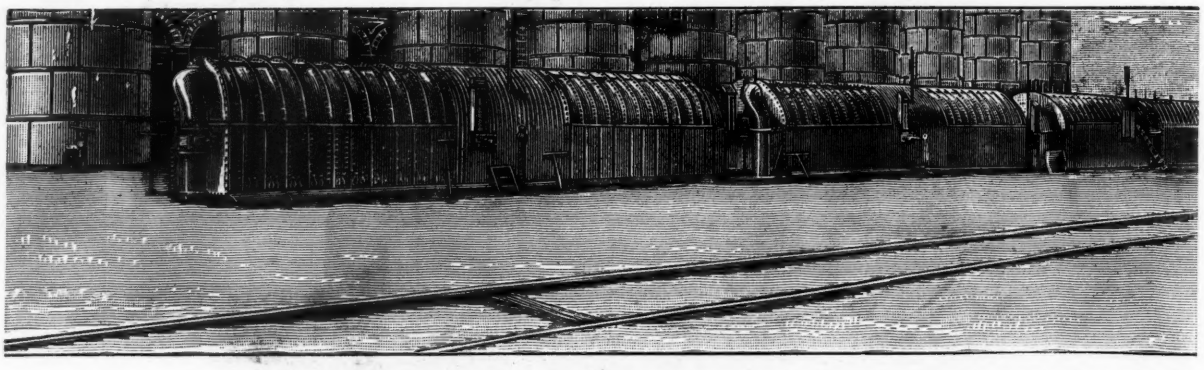
Or their Sole Representatives: D. M. NELSON & SONS, 68, Bath Street, GLASGOW.

KIRKHAM, HULETT, & CHANDLER, LD.,

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.

☞ **465** of these Machines (capable of dealing with **440,807,000** cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company has **27** of these Machines in use; and they are also in operation at a great number of Gas and other Works in this Country and abroad.

Address : 3 & 4, Palace Chambers, Bridge St., Westminster, S.W.

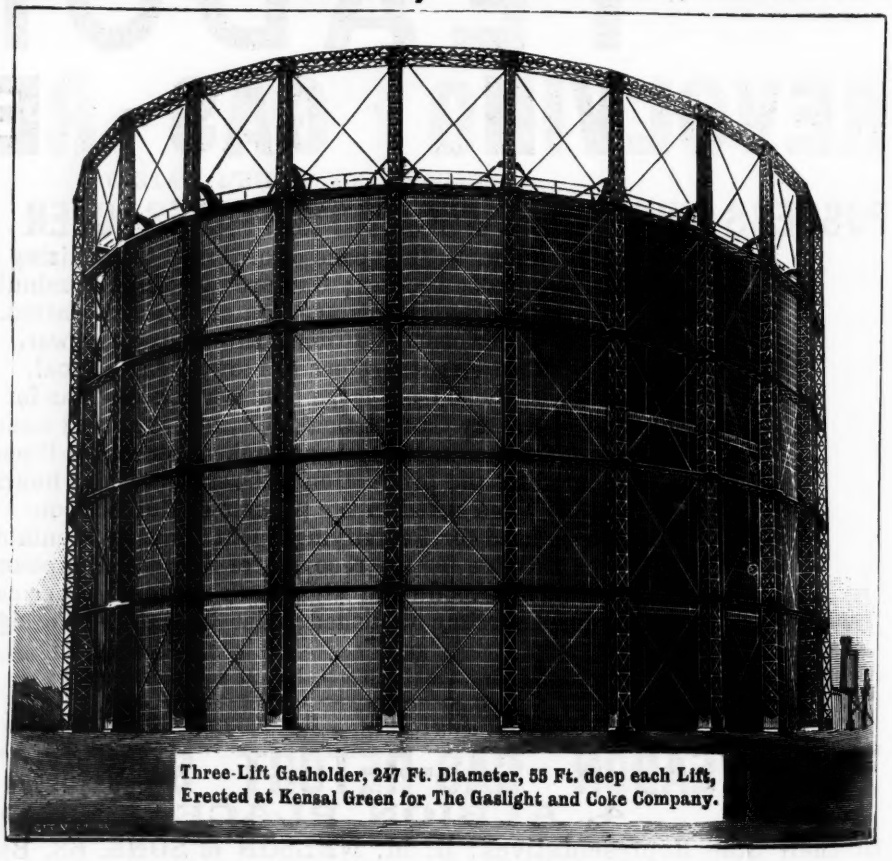
SAML. CUTLER & SONS, MILLWALL, LONDON.

NEARLY

8 MILLION

CUBIC FEET

CAPACITY.

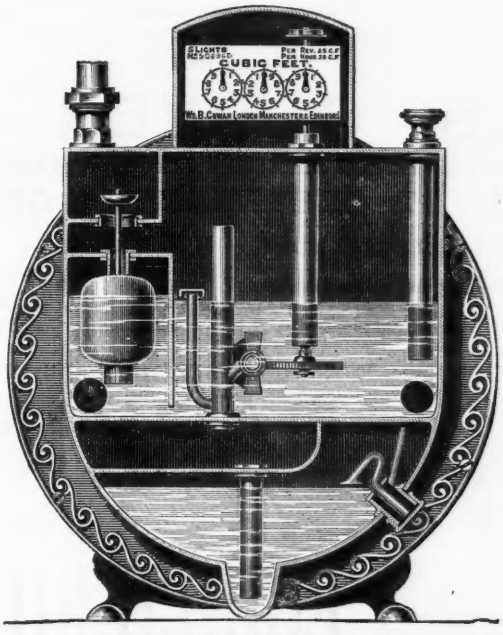


Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

W. & B. COWAN'S WET METERS

IN TIN AND CAST-IRON CASES.

A Speciality in our Wet Meters is **THE WARNER AND COWAN DRUM,** which ensures accurate **registration,** independent of the height of the water-line; whereas, in the ordinary Wet Meter, the evaporation of water tends to make the registration show to the prejudice of the Gas Company.



SECTION OF IRON CASE WET METER.

Another important feature in our Wet Meters is **WM. COWAN'S PATENT SYPHON OVERFLOW,** by which, when watering the Meters, the water-line is attained **with rapidity, certainty, and exactitude;** and it is impossible for any water afterwards to find its way into the waste-box.

THESE METERS STAND HIGH PRESSURES.

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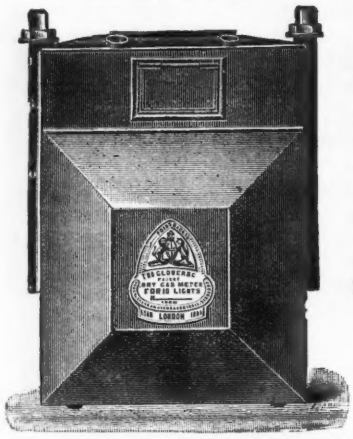
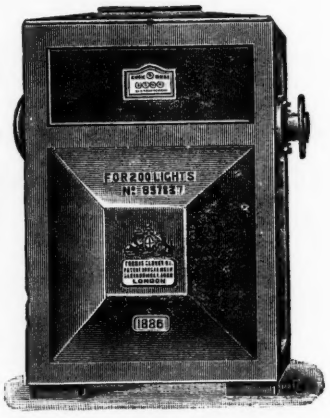
THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.



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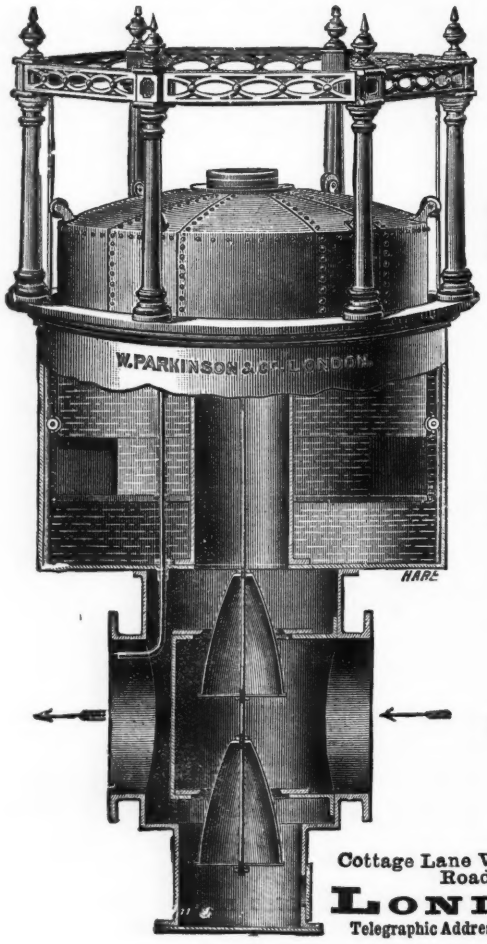

PARKINSON'S

PATENT

EQUILIBRIUM GOVERNORS.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

COUNTERBALANCE or AIR VESSEL, as desired.
TWO, FOUR, or SIX COLUMNS and GIRDERS.
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10, Mawson's Chambers, Deansgate, **MANCHESTER.** Telegraphic Address: "Precision."

[See also Advt., p. 828.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 31, 1893.

The City and Guilds of London Institute and the Journeyman. THE report of the Examinations Department of the City and Guilds of London Institute upon the work of the Department for the session 1892-3 has just come to hand. This statement shows, among other things, that the technology classes registered by the Institute are increasing in popularity, and also that the number of students presenting themselves for examination is steadily growing; having this year attained the very respectable total of 4847. It is even more satisfactory to learn that, while the number of passes has risen, the percentage of failures has fallen. It is not surprising to find that the difficulty of obtaining really competent Examiners who are themselves actively engaged in the trade, and who possess a thorough knowledge of the principles and theory of their subject, tends to increase rather than diminish with the progress of technical education. It has therefore become necessary in many instances, in order to secure the proper combination of theory and practice in the question papers, to associate in many instances the practical manufacturer or craftsman with an experienced teacher as co-Examiners. From the table of subjects and passes, it appears that in Gas Manufacture there were 49 candidates this year, as compared with 54 in 1892. In Coal-Tar Products there was a heavier falling off for the year, of from 17 to 6 papers. In Electric Lighting there was still the comparatively enormous number of 439 candidates this year—eight less than the total for 1892. As we remarked last year, there is nothing but the fashion to account for this craze, as it is certain that there is no possibility of the greater number of these aspiring electric lighting engineers finding paying employment for their knowledge, such as it is. It is a highly significant fact, moreover, that the percentage of failures in this subject rose to 64·9—being the highest in the whole list. This shows that most of the candidates were mere smatterers. Only nine out of the whole number succeeded in obtaining first-class certificates in the Honours Grade. It has been found desirable to send copies of the Examiner's report on this subject to the several centres where candidates were examined, with a hint that the quality of the teaching is not all that could be desired. Very little is said in the report respecting the subject of Gas Manufacture, beyond the remark that this is the only one in which a class was held, while all the candidates are grouped as external. It is curious that out of a class of 25 not one went up for examination. It shows, however, that the subject is not one that can be "crammed." The condition is exactly reversed in the Electric Lighting and Power examination, where 418 candidates came from the classes, and only 21 were external. Of the former, 66·5 per cent., and of the latter only 33·3 per cent., failed. The report concludes with the statement, which is fully borne out by the statistics and references, that the work of the Examinations Department of the Institute continues to develop, and that this development is due "not only to "the increase in the number of classes, students, and "candidates for examination, but also to the constant "demands upon the Institute to assist, in new directions, "through its system of examination and inspection, local "bodies in the organization of classes, and in further im-"proving existing facilities for technical instruction."

While congratulating the Department upon their success in the past, we take this opportunity of pressing upon the managers the duty which lies upon them of doing still more in the way of adapting their programme to the actualities of the arts and handicrafts. They should ponder the moral of the report of the Examiner in Cotton Weaving, where he says that he looks upon the large number of students —2466—who are engaged in the study of one industry, "as a grand augury for the future commerce of this "country, and a very favourable contrast to what only "recently was the case." What is needed now is to identify more completely the ideas conveyed in the two words "student" and "learner." Every man or woman who practises a handicraft must have learnt it; but it does not follow that he or she has also been persuaded of the desirability of "studying" it—that is to say, in the sense in which the term is used in these reports. One would like to see the numbers of students and candidates for examination included in these useful statistics in better agreement with the intrinsic and comparative importance of their subjects as part of the industry of the country. For example, there is obviously something wrong about a system that does not recommend itself to the actual practitioners of the great chemical industries of the kingdom, which this year could find no "students" of salt manufacture, of soap manufacture, of glass making, or of sugar manufacture, and very few of such staple industries as distilling, skin dressing, flax spinning, hat making, and a score of others. There is nothing to complain of with regard to the part played by the Institute in connection with the gas industry; for, upon the assumption that the students and candidates in this subject are wholly drawn from the ranks of those young

men who are preparing themselves for responsible employment in and about gas-works, the list is already in fair proportion to the field. But why does the Institute neglect the gas-fitter, who is such an important personage in the industrial community? We know full well that five out of six of the Institute's students of electrical engineering must eventually find work, if they remain in the trade, as mere linemen and fitters. But this is the wrong way to develop a trade—to degrade its would-be masters into journeymen; the proper and most fruitful course is to elevate the journeyman into the master, in knowledge at any rate. But, with the exception of a very few trades, where is the evidence that the Institute is getting hold of the journeymen to any appreciable extent? There must be, in the half-dozen largest towns in the kingdom, tens of thousands of young men, now (thanks to the Board Schools) no strangers to the idea of study, who are actually learning those staple handicrafts and occupations upon the excellent performance of which the commercial future of this country in a great measure depends. Where are they, that they are so scantily represented in these returns? This is the great question that the Institute has to face; and until it is fairly grappled with, the shadow of the reproach of dilettantism will continue to lie upon the organization.

The Coal War—A Conference Offered.

THE offer made public in last Friday's papers by Mr. T. Ratcliffe Ellis, on behalf of the Federated Coalowners, to meet the miners' representatives for the purpose of discussing the situation, without laying down any stipulation with regard to a reduction of wages which might be interpreted as an attempt to prejudge the issue, is only in accordance with a suggestion made in these columns so long ago as the 3rd inst. We then inquired whether it would not be possible "to get all parties together to consider the general question of what, in the circumstances, "is a fair rate of wages for coal miners and workers." After all, this appears to be nearly the extent to which the associated employers are now prepared to yield to the pressure of unexampled conditions; and it is to be hoped that, before this issue of the JOURNAL reaches the hands of its readers, the meeting will have taken place, and not in vain. It has appeared to us, all through the progress of this deplorable "coal war," that neither side has been blameless in respect of the manner in which the issue was raised and met. As a matter of accountancy, the original contention of the employers was doubtless justified. That they were right in arguing that the current prices of coals did not warrant their continuing to pay the advanced wages of which we have since heard so much, is certified by the action of the men's leaders in refusing to discuss the matter upon this ground. That the amount of reduction as proposed by the employers was quite reasonable, judged from the same standpoint, may also be conceded. All the same, it must have struck the most open-minded observer of such proceedings that the demand for a reduction of wages, and the fixing of the amount at such a high figure, were a direct challenge from the associated employers to the men, and could only be met by the latter in one way. If the employers had begun by inviting a conference in general terms to consider the subject of wages in connection with coal prices, the men's leaders might still have backed out; but their attitude would then have been exhibited in an unmistakeable way.

It is still possible thatneither party to the existing dispute will be inclined to yield. Having stood out so long, both sides may think it not worth while to capitulate before the limits of actual starvation or ruin are reached, in which case the proposed conference will come to nothing. Yet surely the matter will not be carried to such extremities. Enough has been done by both combatants for the sake of "principle;" and if a *modus vivendi* can be arrived at anyhow, no false pride should be allowed to interfere with, or spoil the prospects of, a settlement. Nobody could have thought that the suspension of coal production throughout the Midlands would last so long as this strike and lock-out has already endured. The gas industry in the affected regions has never been subjected to such a strain; and a general rise in price may be looked for as a matter of course, even if work at the pits is resumed early enough to keep the gasholders above ground.

It is greatly to be hoped that the cessation of hostilities between employers and employed in the coal trade will not be rendered more difficult to bring about than it is already, by rash and ignorant claims to victory by the professing friends of the miners, who have to a certain extent succeeded in altering the aspect of the trade—at enormous cost to themselves and to the colliery owners. If the men go in to-morrow upon the old terms, it will not be through their having established the principle that prices must follow wages; and the immutable laws of political economy will not be affected one jot or tittle, whatever be the result of this or of a hundred strikes. To employ the old illustration once more, a man may indubitably roast his pig by burning down his house, if he will; but the question remains whether the result pays for the method of operating. In one of the comic journals of last week, Mr. John Burns, M.P., who has adopted the cry that wages should control prices, is represented in a cartoon in the position of King Canute defying the waves of the sea—the irresistible ocean in this instance being labelled "Political Economy." This is pointed enough, so far as it goes; but the parallel is rendered incomplete by the circumstance that the King of the Danes knew well enough what the result would be, whereas the modern mob-orator is, or affects to be, entirely in the dark in this respect. He and those who go with him do not or cannot see that it is impossible for labour ever to beat capital, in the common acceptation of the phrase. Labour can act in a variety of ways so as to render the outlay of capital in the payment of wages profitable or the contrary. But there is, and can be, no "beating" in this matter. If labour acts so as to render the conduct of an industry unprofitable at the price obtainable for the product of the industry, capital simply withdraws, and seeks "fresh fields "and pastures new." The lesson of the Thames shipbuilding trade has still to be driven home to the comprehension of men like John Burns. As a contemporary truly observes, if the Federation miners should now be permitted to return to work at the old rate of wages, the world will be told "they have gained a great victory—"they have resisted a reduction in wages successfully." In point of fact, they will have done nothing of the kind. They will have paid an exorbitant price, and made other people pay also, for the maintenance of the rate of wages. The result will be artificial and temporary, as it will have been due to an artificial and transitory expedient. No settlement, however apparently complimentary to the counsels of the men's leaders, will avail for a day longer than the persistence of the inflated coal prices paid for at enormous usury, and in unimaginable forms of misery and suffering.

The South Metropolitan Men and the Employers' Liability Amendment Bill.

THAT the *Daily Chronicle*, in its anxiety to pose as the only friend of the working man among the Daily Press of the country, should occasionally allow the zeal of the partisan to far outrun the discretion of the self-styled impartial recorder of passing events, is only what might be expected. When, however, it gives circulation to a vague rumour affecting the conduct of an individual who, even though his name is Mr. George Livesey and his condition that of an employer of labour, is still a human being, it might reasonably be supposed to have some slight justification for the action. Mr. Livesey has never been inaccessible by *bonâ fide* inquirers into the working of the South Metropolitan Gas Company; and before the perfervid reporter for the *Daily Chronicle* ventured to publish the hearsay statement that he and his co-Directors were "trying to coerce" the workmen in their service to take certain action in regard to the Employers' Liability Bill, it would not have been an excess of delicacy on his part if he had asked Mr. Livesey whether or not there was any truth in the rumour. However, this is not the way in which newspapers are written. First catch your rumour, is the rule; or there is "another way," as the cookery-books say—you can make it all out of your head. If it is a particularly spiteful, ungenerous, and baseless attack on a person who is unable, or may be unwilling, to reply, so much the better. This is the unfailing recipe for the preparation of the "smart paragraph." In the present case, the *Daily Chronicle*, after launching its allegation against the Chairman of the South Metropolitan Gas Company, "gives "itself away," as the phrase goes, by remarking: "It will "be distinctly wise for his Board to disclaim the evil idea "imputed to it. We can hardly believe the report is true."

Then why, in the name of all that is sensible and prudent, to say nothing of what is commonly fair and decent, make such charges without inquiry? What the *Daily Chronicle* failed to do, the *Morning* did next day; and, at the cost and trouble of a tramcar trip to the Old Kent Road station, it ascertained that the great and only labour organ had found, as might be thought, another mare's nest. The representative of the *Morning* did more than obtain from Mr. Livesey a good-humoured, if slightly contemptuous, refutation of the allegations in question. He had an instructive interview with the workmen constituting the Committee of the Profit-Sharing Scheme, which happened to be in session; and from them he gathered information respecting the opinions and condition of the employees of the Company which forms anything but pleasant reading for the agitator-ridden labourers who are fast bound in the Unions. It is true that the South Metropolitan workmen have resolved to petition Parliament to include, in the Employers' Liability Bill, a clause in favour of the establishment by employers of some scheme of death and accident compensation, subject to the Board of Trade, which shall be more advantageous to the men and less vexatious to the employers than the bare legal remedy proposed to be granted by the Bill as it is now drafted. But it is tolerably obvious to all, save those politicians who will not see any shortcoming in the Government measure, that the South Metropolitan men, like the employees of the London and North-Western Railway Company, know what they want, and have reason for their demand.

The Artificial Lighting of Workshops.

THE paper on the "Lighting of Workshops" which was read by Mr. B. A. Dobson, of Bolton, before the Institution of Mechanical Engineers on Thursday last, is an example of a kind of technical composition to which it could be wished that gas engineers paid more attention. A brief abstract of the paper appears in another column; but it deserves mention here as one of the strongest statements of the case for good factory lighting that has yet come under our notice. In introducing his subject, Mr. Dobson makes mention, as it were incidentally, of certain facts which afford melancholy proof of the extent to which the smoke nuisance has been allowed—mainly by the unhallowed combination of the forces of ignorance and greed—to darken the sky for millions of the hardest-working people of these Islands. He remarks upon the association of the staple industries of Lancashire with the coal-producing regions; stating how "a large pro-"portion of the manufacturing industries, great and "small, date from a number of years back, when smoke-"consuming and smoke-preventing apparatus had not "yet been devised; and many of the factories are working "at the present day under pretty much the same conditions "as when they started." The result of this is that over the whole of an important district comprised within a 30-mile radius from Manchester, which is said to include a larger population than an equal circle round any other place in the world, the sky ranges always "from dull lead to dark "brown" at any season of the year, if the wind happens to be light. For four years in succession it has occurred at Mr. Dobson's works in Bolton that on the longest day of the year "the gas in every room, amounting to nearly "7500 jets, has had to be lighted by eleven o'clock in the "morning, and has remained lighted until work ceased; "and this has occurred also in other towns, and in "weather that ought to have secured abundant sun-"shine." That this picture of a town in the Manchester district as a "City of Dreadful Night" is not exaggerated, will be admitted by every railway traveller who has ever passed from the open country into or through these or similar regions. The impression as of the sun having suddenly gone out is the usual indication of one's approach to an English manufacturing town. With many of Mr. Dobson's remarks upon the common lighting of workshops it is possible to agree; but we cannot follow him in his argument that, because the improper lighting of workshops by gas is a bad thing, therefore it is better to adopt some other kind of light altogether. The solution which Mr. Dobson eventually favoured was lighting by means of inverted electric arc lamps, the direct light of which was screened from the floor, but reflected from whitened walls and ceiling. This is, of course, not a novel device; and for suitably designed shops, it will doubtless answer well. Since it involves a ceiling, however, the inverted arc system of lighting is not capable of universal application. As to its cost, we observe that, like most factory-owners, Mr. Dobson only takes into account the expense of the carbons, ignoring that of the power consumed, and the wear and tear of the electrical machinery. If the dynamos were a present, and somebody has promised to replace them for nothing when they wear out, Mr. Dobson is to be congratulated on his good fortune. However, we shall not quarrel with him on this account, but thank him for a paper which may set many gas managers thinking that they might sometimes find it to their employers' advantage to help large consumers to use gas intelligently, in view of the fact that the comparison of gas lighting is no longer with ineffective oil and candles, but with the full resources of modern electrical science.

WATER AND SANITARY AFFAIRS.

THE development of the system of water supply in certain of the great commercial centres of the North will be watched with clsse interest by many of our readers. This is the time of year when the Corporations give an account of their stewardship, and count the cost of their enterprise. Only last week we chronicled the position of affairs at Liverpool, Newcastle, and Middlesbrough. In the former city, a feeling of congratulation prevails; and, indeed, the Liverpool Water Committee have abundant reason to be well pleased with the way in which they have emerged from the serious ordeal of the summer drought, and with the healthy footing on which their works have now been placed. They claim to have supplied 11 million gallons per week in excess of the supply of the previous year; and, while maintaining an abundant service to the citizens, who have the first claim to it, the Committee were able during the dry weather to come to the rescue of outsiders, who were exceedingly glad to pay for what they received. These arrangements with neighbouring communities are likely to be extended in the near future; and the Liverpool Water Committee are evidently prepared to meet outside applications, without diminishing in any way the supply required for the City of Liverpool itself. The Chairman of the Committee (Mr. Alderman Hughes) enlarged upon these matters in terms of justifiable satisfaction; and he also referred incidentally to the extremely important system of telephonic communication which has now been established throughout the whole of the Vyrnwy and Rivington works. This system has been admirably organized. It covers no less than 120 miles, and affords facilities for transmitting messages and instructions from one district to another—the advantage and convenience of which could scarcely be over-estimated.

At Middlesbrough, too, there has been hand-shaking all round over the progress of the important works which have for some time been in hand in the valley of the Balder. Thither went the Middlesbrough members of the Water Board, as recorded in last week's JOURNAL, in order to make manifest, and afford ocular demonstration of, the rapidity with which the enterprise is being pushed to its completion. There has been a disposition in some quarters, it seems, to find fault with the Water Board, and to minimize the character of the work in hand. Mr. Alderman Bell certainly succeeded, however, in convincing his hearers of the magnitude of the undertaking upon which the Water Board are embarked. Rome was not built in a day; and works such as those on foot in the valley of the Balder cannot safely be completed with the rapidity associated with the operations of the jerry-builder. The Alderman mentioned by the way that the whole undertaking has cost, up to the present time (including the amount expended in the purchase from the Water Company), a sum of £1,700,000.

The discussion in which the City Council of Newcastle have been engaged, necessarily turned upon the probable necessities of the future rather than the actual achievements of the past. The discussion, however, was exceedingly instructive—particularly in view of some observations which we recently made on the dilatory tactics pursued by certain Corporations in regard to the acquisition of water-works. Mr. Alderman Cail, whose painstaking recapitulation of the facts was, unhappily, followed by a fatal seizure, revived the idea of bringing a supply from Ulleswater to the Tyne Valley; and he included in his review the history of past negotiations with the Newcastle

and Gateshead Water Company. Twenty years ago, the Company were prepared to sell their property, which then represented a capital of £632,000, at a premium of £5 per cent., or a sum of £663,600 for the whole concern, stock and block. The late Mr. Thomas Hawksley, who was professionally consulted, recommended the purchase at that price; but there were divided counsels in the municipalities interested, and after considerable controversy the scheme fell through. What is the position of the Company now? Their capital at the end of 1892 was £1,364,763—or more than double the total in 1874—without taking into account the further capital expenditure now being incurred. Mr. Alderman Cail put the actual capital at the present moment at £1,500,000, and the market price at £225 per cent., which would give a total of £3,825,000—a difference of £3,161,400 between the present market value and the price the Company would have accepted in 1874!

A curious example of wrongheadedness and perversity came to light before the Portsmouth Magistrates on Friday last, when Mr. Holder, a local pork butcher, was summoned for hindering one of the inspectors of the Portsmouth Water-Works Company in the discharge of his duty, under the Portsmouth Water-Works Act, 1873. This, it seems, is the Act which regulates the constant water supply, which the inhabitants of Portsmouth have now enjoyed, without interruption, for a period of nearly twenty years; but, speaking broadly, there can be no constant supply if everyone is at liberty to waste water and adopt fittings that are unfit. The obligation to maintain a constant supply must necessarily have its correlative provisions for checking waste and inspection of water-fittings. The reasonableness of this very obvious qualification Mr. Holder, the defendant, does not seem to have successfully grasped. Persistently and repeatedly, according to the statement of the Solicitor who appeared on behalf of the Company, he refused to let the inspector do what the Act empowered him to do. Hence the proceedings, which, however, were not pursued to the bitter end of fine and costs, because the defendant seems to have realized, after service of the summons, that it was unwise to fly in the face of the law. He bowed to the chastening rod of the Legislature, and discreetly allowed his premises to be inspected before the case came on for hearing. The Company were not disposed to be vindictive; and the informations, therefore, were withdrawn. Assuredly, it is a noteworthy fact that, in so large a town as Portsmouth, it has not been found necessary hitherto to enforce penalties by reason of any contravention of the Company's numerous Acts—the first dating back to 1857. Such a clean sheet speaks well for the administration of the Company's affairs, and for the good sense of the Portsmouth water consumers.

Imperial Continental Gas Association.—At the meeting of this Association next Tuesday, the Directors will recommend the declaration of a dividend of 5 per cent. for the six months ending June 30 last, and a bonus of 1 per cent. (both free of income-tax), on the £3,800,000 stock.

Coal and Iron in France.—The production of coal in France in the first half of the present year was 12,807,297 tons, as compared with 12,864,754 tons in the corresponding period of 1892, showing a decrease of 57,457 tons this year. The extraction of coal in the basin of the Nord and the Pas de Calais in the first half of the year amounted to 7,207,767 tons. The Loire ranked second, with a production of 1,737,646 tons; Burgundy and the Nivernais third, with a production of 971,858 tons; and the Gard fourth, with a production of 970,780 tons. There was then a rather abrupt drop; the output of the Tarne and the Aveyron in the first six months of the year having been 710,781 tons, and that of the Bourbonnais 577,739 tons. The output from each of the other French basins was less than 200,000 tons. The production of pig in France to June 30 this year was 1,005,360 tons, as compared with 1,017,062 tons in the corresponding period of 1892—showing a reduction of 11,702 tons this year. The make of iron was 414,407 tons; of iron rails, 485 tons; of miscellaneous rolled iron, 357,618 tons; and of plates, 56,304 tons. The production in the corresponding period of 1892 was: Iron, 423,965 tons; iron rails, 244 tons; miscellaneous rolled iron, 361,673 tons; and plates, 62,048 tons. The quantity of steel made was 329,961 tons, as compared with 331,939 tons in the first half of 1892. Steel rails were made to the extent of 117,804 tons; miscellaneous rolled iron, to the amount of 153,892 tons; and plates to that of 58,205 tons. The production the corresponding period of 1892 was: Steel rails, 119,319 tons; miscellaneous rolled iron, 153,313 tons; and plates, 59,307 tons.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 818.)

THINGS have not been quite so dismal on the Stock Exchange during the week just concluded as they were reported to be in the preceding week. The improvement turned almost entirely upon the position of the silver civil war in the United States. The forces represented by the President stood stoutly to their guns, resulting in what looks like a capitulation on the part of the Silverites, who, like the immortal 'coon of their country, concluded to "come down." This promising phase of affairs brightened up things greatly; and prices went up until it was time for some to realize, and this checked them a bit. A satisfactorily concluded settlement also helped to maintain the generally cheerful aspect. Unfortunately, the coal strike is still raging with much bitter feeling; and, though renewed attempts are on foot to effect terms of settlement, there is no knowing what the upshot may be. Consequently, rails and everything else influenced by the coal trade have suffered in the market. The Money Market has fluctuated somewhat; but rates are not likely to move much in the absence of any pronounced demand from abroad. The Gas Market has been rather quiet on the whole; and prices, even of high-class undertakings, have relapsed. There is no apparent reason for this, except the general rule of "after a rise, a fall." The only exceptions to the retrograde movement are the secured issues, which show a further advance. In illustration of the general demand for this class of security, it may be noted that the Sheffield Gas Company last week issued £25,000 of 4 per cent. debenture stock by auction, and realized an average price of over 125—the top price for some lots being 131. In Gaslights, the "A" was weaker, opening at 229, and then falling till the lowest price of the week (224) was marked on Thursday. Subsequent dealings were a little better. The secured issues were in good demand; and the "B" and "G" advanced in value. South Metropolitans were quiet, and presented no feature, though, for some reason or other, the "C," which was not dealt in, was put 1 lower. Only a couple of bargains were marked in Commercials at middle figures. Nothing was touched among the Suburban and Provincial Companies, except British; and quotations did not move. Of the Continentals, both Imperial and European receded; but Union was firm. Malta also fell ¼. Fears that the low rate of exchange during the year must affect the divisible earnings of Indian undertakings caused a fractional fall in Oriental. Among the South Americans, Buenos Ayres slightly improved. Water was fairly active at the old prices; and the only change was an advance in Grand Junction.

The daily operations were: Gas showed signs of weakness at the opening, Gaslight "A" receding 1½, and prices generally were not buoyant. Grand Junction Water rose 1. The course of business on Tuesday was more chequered. Gaslight "B" gained 2; and Buenos Ayres, ½; but Malta and Oriental fell ¼ each. Wednesday was a quiet day. Gaslight "G" advanced 3; but ditto "A" and Imperial Continental receded 2 each. On Thursday the only change was a fall of 1 in South Metropolitan "C." Friday's business was very limited. Europeans dropped ½ each. Saturday presented nothing remarkable; and all quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Danger of Overhead Electric Wires—Electric Cooking Toys—More Trouble at St. Pancras—Retrogression of the St. James's and Pall Mall Company.

A MOST instructive illustration of the evil consequences that, though long delayed, are certain at some time or other to overtake "cheap and nasty" work, in electrical engineering as in other matters, is supplied in a piece of news from Baltimore. A great storm passed over the United States on the night of the 13th inst., during which two electric light wires became crossed in the tower of the Brush Electric Light Works, with the effect of setting light to the structure. Pieces of burning material were blown on to the roof of a gaol situated near by, wherein a large number of prisoners were confined at the time; and the building was burnt down. The inmates were rescued with difficulty; one man being killed and twenty injured. The money loss incidental to the fire was heavy; and the amount of public and private inconvenience and alarm, due to the same cause, must have been serious. It is such incidents as this that may be quoted in order to justify the British policy of "making haste slowly" in the matter of distributing strong currents of electricity for the lighting of towns. If it had not been for the much-abused Electric Lighting Acts, most of the populous places within the United Kingdom would probably have been overrun with aerial electric wires for various purposes, nominally owned by speculative companies for the most part unable to maintain them in decent condition; and catastrophes like that of Baltimore would not have been unknown among us. There are quite enough electric lighting accidents as it is; but the list of British casualties under this head is short in comparison with the American record.

As usual, the newspapers and cheap popular weekly periodicals are giving every encouragement to the electricians in

regard to the curious electrical cooking appliances, which some of the dealers in electrical "knicknacks" are endeavouring just now to push, with energy deserving of a more hopeful cause. Hardly a week passes without some self-styled electrical expert being "interviewed" for the benefit of one of the publications of the *Tit-Bits* order, which grants him bold, and apparently gratuitous advertisement for his electrical frying-pans and flat-irons. Some newspapers are sufficiently well-informed to smile compassionately over these efforts to force electricity to uses for which gas has only become popular during the last few years; but there is a smack of piquancy about the very idea of warming shaving water by means of tamed lightning, which tempts the topical paragraphist to turn to the subject whenever he stands in need of a pseudo-scientific "motive." Of course, there is nothing in the idea, regarded from the commercial point of view. Even if electrical cooking apparatus were as effective upon the basis of fuel consumption as a common gas-heating burner costing a few pence, the supply of what stands for fuel would still cost as much as gas at 6s. or 7s. per 1000 cubic feet—a price at which the most sanguine gas-stove merchant would confess his inability to do much business. As these appliances go, however, they can only effect the simplest of so-called cooking operations, at a rate of useful duty considerably below that of the gas-stove; and in any case a cheap oil-lamp—to say nothing of gas—is far and away their superior in every essential. For confirmation of this criticism, it is only necessary to hear what one maker of these electrical toys has to say concerning the wares of a rival tradesman.

A pretty little difficulty has arisen between the St. Pancras Vestry and their contractors for the public street arc lamps—the well-known firm of Messrs. Johnson and Phillips. The Engineer has reported that the final payment to this firm on account of their contract for the lamps may be made; but a question cropped up about the payment of seven guineas per week charged for trimming these lamps, which the Vestry regarded as excessive. Negotiations have been proceeding for some months, with a view to the settlement of these claims; and, in order to close the matter, Messrs. Johnson and Phillips have expressed their willingness to accept a sum calculated at five guineas per week, although they declare that this does not cover the expense to which they have been put in the matter. This offer has been considered by the Committee, who have arrived at the conclusion that an offer of a lump sum of £500 should be made to the contractors, in full discharge of all claims. Messrs. Johnson and Phillips have declined to settle on these terms; and the matter is still hung up. The lamps in question are henceforward to be trimmed by the Vestry's own men. It would be interesting to know how all these difficulties affect the working out of Professor Robinson's original estimate of the cost of electrical supply in St. Pancras.

A small paragraph appearing in the *Electrical Review* for the 20th inst., seems to call for some notice. It states that "the electric current sold by the St. James's and Pall Mall Electric Light Company, Limited, during the quarter ending Sept. 29, amounted to £4820, as against £5763 for the corresponding period of 1892." And the pertinent inquiry follows, "Why this retrogression?" The question is one that must be answered when next the Directors of the Company meet their shareholders. Does it mean that the "point of saturation" of the district for electric lighting has been reached at so early a stage in the career of the undertaking? If this is the true solution of the problem presented by this sudden check upon the expansion of the Company's business, it will create widespread consternation among the people who have confidently expected the rapid growth of public station lighting in London during the last few years to continue for many years yet to come. It has never been publicly admitted by the partisans of these central station lighting companies, that the extent of the demand for the electric light was within measurable distance of being sounded. Their business has gone ahead with a rush, like the roller-skating speculations when they first came out; and the increases of the first two or three years after the stations were ready to supply customers, were regarded by their friends as merely an earnest of what future years had in store. Is the rush already over? If so, it will take more than the advent of eighteenpenny lamps to repair the fortunes of these concerns.

An Invention by Mr. W. J. Dibdin.—The London County Council have, on the recommendation of the General Purposes Committee, granted permission to their Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.) to take out a patent for an invention in which the principle of the polarization of light is applied to photography. This permission is required by the Standing Orders of the Council.

Association of Birmingham Students of the Institution of Civil Engineers.—The first meeting of this Association for the present session was held last Thursday evening, at the Midland Institute, Birmingham, when the President (Mr. Charles Hunt, M.Inst.C.E.) delivered his Inaugural Address, taking for his subject the Birmingham Corporation gas supply undertaking. It is not possible to do more than notice the subject of the address in this week's JOURNAL; but next week some extracts from Mr. Hunt's very interesting remarks will be published in our columns.

THE DESIGN OF RETAINING WALLS.

THE design and construction of retaining walls is a subject of perennial interest for engineers, both on account of the frequency with which practical problems of this description present themselves, and also by reason of the difficulty of the theory of the subject. Text-books of engineering construction give several formulæ more or less applicable to problems of this kind; but there is always present in the minds of engineering students a suspicion that text-book rules may be obsolete, without conveying any notification of the fact, and they are glad of contemporary articles and papers giving the fruits of the latest observation and experience. The literature of retaining-wall construction is extensive; but this consideration does not prevent additions to the stock of information on the subject. One of the latest of these is by Professor Merriman, of the Lehigh University, which is little more than a statement of the recognized and accepted principles of retaining-wall design; but how hopeless is the search for finality in the theory of the matter, is admitted in so many words by the author, who declares respecting the most important factor in all problems of the kind—the resultant P of the total pressures upon the wall—that "the theory of earth pressure is not sufficiently explicit to determine the exact value and direction of P . . . The effect of the variable data is often so great that a ripe judgment, based upon experience, may be more reliable than computations." This being so, it is a defect of Professor Merriman's book that he does not cite a single example from actual practice, either of successful or unsuccessful retaining-wall building, which drives one to the conclusion that anyone who wants to know all there is to be known of the subject, while keeping his mind open to precepts endorsed by respectable authority, will find the best guidance in recorded examples both of success and of failure.

Yet it must not be hastily concluded that an engineer who has to construct a quay wall, a gasholder tank, a water reservoir, or a coal-store, or to embank a low-lying site, cannot find some guidance in what passes under the name of the theory of retaining-wall design, most of which is merely the result of systematized observation of facts. Only, at every stage of the inquiry, it is desirable that data intended for use in computation should be connected with, and based knowingly upon, example. For this reason, it is possible to highly commend a series of articles upon retaining walls contributed by Mr. Kenneth Allen, member of the American Society of Civil Engineers, to the *Engineering Record*. This writer begins by confessing that his chosen subject is one which still remains to be treated in a practical and comprehensive manner, although no class of structures plays a more important part in the work of the constructing engineer. All that he claims to do is to explain the way in which the study of the subject can be most intelligently approached, with due regard both to what has been accepted by competent engineers as to theory, and to methods of construction that have stood the test of practice. This is exactly the kind of assistance the young engineer requires, in connection with all branches of his studies.

With regard to any particular example of retaining-wall construction, the natural question of whether it will stand raises the consideration of the various ways in which it may fail, which are numerous. As classified by Mr. Allen, failure of a retaining-wall may occur (1) by sliding horizontally on a bed joint or on the base; (2) by bulging of the face; (3) by rotation or overturning; (4) by rupture of the masonry; or (5) by instability of the foundations. It is rarely that a wall fails from sliding; but this is possible with a light wall, smooth, unbonded bed joints with poor mortar, and with a semi-fluid backing, especially if surcharged. A case is cited where a wall failed in this way, although it had a base equal to 0·66 of the height. But it had a smooth foundation, and the backing acted like a wedge. It was replaced by a wall only 0·26 of the height in thickness at the base; but this stood because it was stepped into the foundation, and the slope at the back of it was also stepped before the filling in was done. Failure by sliding, bulging, or overturning is caused by excessive thrust from the backing; and hence the same precautions are required to avoid it from any of them. Whenever possible, the backing should be drained; but where this cannot be done, allowance must be made for the extreme case of a backing saturated with water and acting with all its weight like a fluid. Very properly, Mr. Allen advises that all clay should be kept as far as possible from the back of a wall; but apparently he does not know how good ordinary town's refuse is for filling.

He next discusses the most usual methods of increasing the stability of walls, by providing relieving arches at the back, putting a block before the toe, tying back walls with rods, and building counterforts at the back. But he comes to the conclusion that the best way is to increase the thickness of the wall itself, and so make it secure without relying upon these adventitious aids to strength. It is cheaper, also, as a rule, while one is about it. The great value of iron bands for ensuring longitudinal cohesion must also be insisted upon.

Mr. Allen dwells upon the necessity for watching "green" walls, to see if they betray any tendency to leaning forward; and he seems to favour the temporary strutting of such walls in certain circumstances. As to the expedient of curved batters, radial joints, or inclined joints of masonry near the base of the

wall, he admits their advisability as a matter of principle, when the friction on the bed joints is but slight—as in dry rubble walls—or when the pressure to be expected from the backing is excessive, or when the filling-in has to be done while the masonry is still green. It is pointed out, however, that this method should be avoided when the foundation is on compressible soil. As an example of good modern design in a retaining wall intended to cope with all ordinary conditions and a severe climate, Mr. Allen cites a standard design of the New York Central and Hudson River Railroad. It is built of rough-faced random ashlar, of good quality. The example given has a base of 7 ft. 7½ in., on a rectangular foundation, for a height of 18 feet, or a ratio of about 0·42. The front has a batter of ¾ inch per foot; and the back is stepped 12 inches at a time, at three successive heights of 4 feet from the foundation. This is to allow the backing to rise freely under the influence of frost. The wall is 2 feet thick at top, and is crowned with a 2 ft. 6 in. coping block. Mr. Allen remarks that it is good practice to leave the back of a wall rough, to increase the friction; but no large stones should be left projecting into the backing.

When walls are to be faced with either much lighter or heavier material than the back and heart, it is best to leave a smooth joint between them, to prevent fracture from uneven settlement. Upon general principles, however, Mr. Allen discountenances the multiplication of classes of material in the same wall structure, as liable to lead to mistakes when the engineer's back is turned. The pointing of the face of a wall is an important matter; and Mr. Allen advocates simple flush-pointing in good cement mortar as best for durable work.

Upon the subject of calculation of resistance to overturning of retaining walls, Mr. Allen candidly says that, while this has been discussed for nearly a century, agreement with actual results is as far from attainment as ever. The first rational theory of earth pressure prepounded was that of Coulomb, dating from 1784, which was followed up to 1840. It rested on the assumption that the wedge-shaped mass of backing tending to overturn the wall presses as a fluid on a point on the back profile of the wall at one-third its height, and in a horizontal direction. In 1840, Poncelet introduced a modification of Coulomb's formula, based on the assumption that the angle between the line of pressure and the normal to the wall is equivalent to the angle of repose of the backing—usually about 30° or 35°. This formula held good until 1878, when Weyrauch proposed a more rational formula still, by which the line of pressure is located in general between Coulomb and Poncelet. Like them, however, Weyrauch neglects cohesion in the material. All three formulæ are consistent, yet they need judgment in the application; for if a wall is assumed to incline towards the backing, they will give results absurdly small. Both Professor J. B. Johnson and Sir Benjamin Baker have tested Coulomb's formula by experiments, and arrive at the conclusion that, when it shows a wall to be on the point of overturning, the structure actually has a factor of safety of about 2. It is therefore incorrect on the safe side. Mr. Allen gives the usual constants for the weights of different materials, and the angles of repose of different soils; but as these as well as the formulæ in which they are employed to find the resultant thrust of the earth occur in all text-books, they need not be repeated here. We therefore proceed at once to the consideration of the final section to be given to the wall.

Supposing we have found a rectangular wall satisfying the conditions of a particular case, masonry may be saved by battering the face and stepping the back. As the face-batter must not be too great, on account of the action of rain, we may assume this at pleasure, and as passing through the face of the rectangular wall at one-tenth its height. Then we may also slope or step the back, following a profile given by allowing a proper width at the top and drawing a line from this through a point situated midway in the height of the original rectangle at the back. In this way, the rectangle is modified into a trapezoid. Before settling upon any such section, however, it is essential to compare it with sections that have proved serviceable in actual practice. The dimension that governs the design is, generally, the breadth of the base; and the following short rules have been given by various authorities for determining the safe values. Let us take h = the height of the wall, t = the thickness at the base, t_1 = the thickness at the top. Then, for ordinary earth banks, Sir Benjamin Baker makes $t = \frac{h.}{3}$ Mr. Arthur Jacob, for saturated earth, makes $t = 0{\cdot}7\,h$, and $t_1 = 0{\cdot}3\,h$. Trautwine allows, for first-class masonry in mortar, $t = 0{\cdot}35\,h$; for common scabbled masonry in mortar, or for brickwork in mortar, $t = 0{\cdot}4\,h$; for good dry rubble walling, $t = 0{\cdot}5\,h$. These values assume a vertical back and face batter not exceeding 1 in 8. The formula used in the construction of the Pittsburg, M'Keesport, and Youghiogheny Railroad, was for first-class masonry $t = \frac{h}{3} + 2$ ft. 6 in.; $t_1 = 2$ ft. 6 in.

Mr. Constable says he is inclined to think the close fitting of earth backing to the wall of more importance than good cement or mortar, careful bond or large stones. Mr. Allen has not much to say about cement concrete walls, of which he has but limited experience; but manifestly his observations about the advisability of simplicity and uniformity of section, apply most forcibly to this class of structure. It should be remarked that, where there is anything like an arch, or a self-contained structure, such as a gasholder tank, the employment of iron bars for bond enables the concrete work to be reduced to dimensions that framers of formulæ and writers of text-books have no idea of. Straight dock and wharf walls, however, must depend for their stability wholly upon the coherence of their material and their weight. As a matter of fact, such walls fail oftenest by bodily movement forward, and not by overturning. For dock walls, Mr. Alfred Giles allows for a head of water equal to the weight of the wall. Where a great width of base is required, Mr. Allen suggests that good use can be made of layers of railway metals bedded in concrete—the adjacent layers crossing each other. These, having so great transverse strength, can be stepped a foot or so in width for every 5 inches in height, and so provide a wide bearing with but little bulk.

Mr. Allen observes in conclusion that the construction of retaining walls necessarily requires a degree of sound judgment on a variety of points relating to materials encountered and employed, and the proper disposition of the latter, and in this way contrasts with other branches of construction, where an exact analysis of natural laws and forces is of paramount importance. "At the same time, the engineer who would keep pace with the more progressive of his co-labourers, will neither fail to appreciate the value of a careful study of all those conditions which affect his work, nor to recognize the fact that a more complete knowledge of the theory of his subject tends to a more scientific design, and this to greater economy—the goal of all true engineering."

Inclined Retorts at the Huddersfield Gas-Works.—A large installation of inclined retorts, comprising twenty beds of nines, 15 ft. long, and 21 in. by 15 in. ⏢ section, has been erected at the Huddersfield Corporation Gas-Works. The beds are arranged ten on each side, back to back, with the charging-stage between them. Each row has a separate system of coal-handling plant, and is so designed that the conveyors can be fed by either of the elevators. The retort-house was originally built for the horizontal system; and ten beds of 20-feet through retorts were erected in one-half of the house. The Engineer (Mr. W. R. Herring) decided last year to introduce the inclined retort system; and the twenty beds now erected complete the house. At the opening ceremony last week, the first retort was charged by Mr. Alderman B. Stocks, the Chairman of the Gas Committee; other members performing a similar operation upon the remaining ones. The discharging of the retorts was certainly an equal feature with the rapid charging. The coal being well burnt off, the coke slid out directly the mouthpiece door was opened, to the extreme satisfaction of the visitors.

The Water-Gas Syndicates.—*Industries* says that there is a great amount of talk in commercial circles in Glasgow with regard to the manner in which the Directors of the British and North British Water-Gas Syndicates and of the Yorkshire Company are forcing on the amalgamation of those various concerns. They are able, it is said, to control a majority of shareholders' votes; but in the Glasgow district at least, their policy is almost universally condemned. For the shareholders of the North British Syndicate, there seems to be little or no hope of preventing the wasting of a sum of £12,000, which, they maintain, rightfully belongs to them. The situation is regarded as being a very remarkable one, as it is alleged that, if any impartial and fairly intelligent business man were asked his opinion as to the course now being pursued, the chances are he would condemn it without the least hesitation. It is urged that there ought to be some means of compromise discovered, at the very least. If the original promoters of the Syndicates are still of opinion that there is some useful future in store for water gas, they might, and ought to, it is affirmed, devise some method of having it tested in an inexpensive form, so that the money of the North British shareholders should not be entirely lost.

Peroxide of Hydrogen as a Disinfectant.—The disinfecting properties of peroxide of hydrogen have long been known; but considerable additions have recently been made to our more exact information as to its bactericidal action. Its hygienic importance, especially in regard to its action upon bacteria in water, has been shown by the interesting experiments of Van Tromp and Altehoefer, to which reference was made in a recent number of *Nature*. According to the former, an addition of peroxide of hydrogen in the proportion of 1 part in 10,000 parts of the water, when shaken up and allowed to stand for 24 hours, is usually sufficient to sterilize a water. Altehoefer, however, found that, to ensure sterility, it was advisable to use larger quantities—viz., 1 part in 1000 parts of the water. Experiments made with waters purposely infected with cholera and typhoid bacilli, respectively, showed that in both cases these organisms were destroyed after 24 hours by this proportion of peroxide of hydrogen. Altehoefer, moreover, specially mentions that he found this addition in no way interfered with the dietetic value of the water; and he recommends its application for household purposes as a protective measure during any epidemics of typhoid fever and cholera. Traugott also testifies to the innocuous character of this material, even when swallowed in large doses. Care must, however, be taken that it is as pure as possible; moreover, it is important that the sample should be freshly prepared, as its strength and consequently bactericidal action is reduced when preserved for some time.

THE MEETING OF THE MIDLAND ASSOCIATION OF GAS MANAGERS.

The members of the Midland Association of Gas Managers held a very successful meeting in Birmingham on Thursday last; the attendance being good, and the programme of the day full of interest, of a kind. The Association has suffered during the past year from a dearth of papers; all the efforts of the President, Mr. B. W. Smith, of Smethwick, and the Committee, and the energetic Honorary Secretary, Mr. C. Meiklejohn, of Rugby, having been powerless to produce the technical *pabulum* that usually goes to swell the printed Transactions of a society of this kind. Notwithstanding this lack of formal contributions to the literature of the gas industry, it remains a notable fact that the attendances at the various meetings of the Association throughout the year have been very good indeed; and Thursday's gathering, as already observed, was no exception to the rule. This circumstance is the more noticeable inasmuch as there are few Midland gas managers free just now from consuming anxiety with regard to their coal supplies. As a matter of fact, however, those who met together in Birmingham last Thursday seemed glad of the opportunity of exchanging notes on so engrossing a subject; and this very circumstance illustrated in one salient aspect the utility of these gatherings—the presence of a common trouble having the effect of emphasizing the brotherhood of gas managers of a particular district in a way that is rarely so conspicuously seen.

There is nothing to call for comment in the proceedings of the meeting before luncheon, which were purely formal; consisting of the election of officers, &c., for the ensuing year. Mr. R. O. Paterson was chosen by acclamation President for the third time—an unmistakable proof of the esteem in which the worthy Cheltenham Gas Engineer is held by his nearest colleagues. After luncheon, the members proceeded in brakes to the Midland Railway goods yard, where, under the guidance of Mr. J. Brookes, they inspected the Pintsch oil-gas works, where the gas for lighting the railway carriages is prepared and compressed by means which are now too familiar to need description or comment, and also the machinery for the extensive electric arc lighting of the railway yard. From here the visitors drove to the Windsor Street gas-works of the Birmingham Corporation. There they were received by Mr. Charles Hunt, and conducted over this ever-growing establishment, where there is always something novel and instructive to be seen in the way of gas manufacture and treatment. Here an object of interest was Mr. Hunt's improved washer-scrubber; and the several current varieties of carbonizing plant were also in action side by side. Foulis and Arrol's hydraulic retort charging and drawing machinery was in full work; and the same may be said of the settings of inclined retorts. The different systems are receiving a severe trial just now with the various descriptions of coal which force of circumstances compel the management to make use of; and it was easy to understand that the services of the Clark carburettor are peculiarly valuable in keeping up the quality of the product to the standard set by the Gas Committee. Although the hydraulic plant has only been in work a very short time, it was answering the expectations formed respecting it, and even better duty will, in all probability, be obtained from it with fuller experience. Mr. Hunt is also putting in extensive coke conveying, elevating, and screening plant for his huge retort-houses, which should result in an important saving of labour and an improvement of the commodity for the local market. There is every prospect that the coming winter will be a busy time at Windsor Street. The same may be said of Saltley, where, as already reported in the Journal, Mr. Hack has lately been making great improvements in the supersession of hand labour by machinery. This station, however, was not visited on Thursday, because it was not expected that Mr. Hack would have returned from his holiday in time to receive the Association. In the evening, many of the members took tea together; and those that could do so stayed to hear Mr. Hunt's presidential address to the local branch of the Institution of Civil Engineers' Students Society.

The New Croton Water Supply for New York.—This great undertaking, which was authorized by the New York Legislature in 1883, is now practically finished, as far as the aqueduct is concerned—the only work remaining to be done being the completion of some of the shafts and gate-houses, which had to be deferred, in order that the aqueduct might be brought into use as soon as possible. The cost was originally estimated at $15,665,000; but this sum has been already doubled. The construction of the aqueduct was only a portion of the scheme of water supply which was entrusted to the Commission; and it is expected that the remaining works will occupy them for another ten years at least. They comprise the provision of storeage reservoirs in the Croton watershed, some of which have been constructed. An important work lately taken in hand by the Commission is the building of a storeage reservoir north of the Harlem River, so that, if the flow of water from the new aqueduct should be stopped for any length of time, the city would be protected from the inconvenience and danger of an inadequate supply.

COMMUNICATED ARTICLE.

HIGH V. LOW TEMPERATURE IN THE CRACKING-UP OF OILS.

By R. S. Moss.

It would perhaps be advantageous to direct attention to the principles underlying the different methods now in vogue for cracking-up oils, to obtain a rich gas, and thus enable one to form an independent opinion. In dealing with the various oils, we have first to consider the predominating series of hydrocarbons which exist in the particular oil we intend to use; also whether the heavier or lighter hydrocarbons predominate. The lighter the series of hydrocarbons, the lower the specific gravity of the oil. Such an oil would be dangerous to store, in comparison to another, in which the heavier hydrocarbons predominate; and the series to which these hydrocarbons belong will make some difference, as to the mode of treating, so as to obtain the best results.

It is found that different oils are, for the most part, made up of a number of complex hydrocarbons. For instance, the crude paraffin oils obtained from shale by destructive distillation are made up of members of the olefine series ($C_n H_{2n}$), with varying quantities of true paraffins ($C_n H_{2n+2}$), some acetylene ($C_2 H_2$), with traces of benzol ($C_6 H_6$). Russian naphthas are made up of the same series of hydrocarbons in varying proportions; whilst the Canadian and American petroleums, contain most bodies of the true paraffin series, with varying quantities of olefines, and traces of benzol ($C_n H_{2n-6}$). Consequently, we find, as might naturally be expected, that natural gas in the neighbourhood of these petroleum springs contains a large quantity of the lighter and more volatile members of the paraffin series ($C H_4 + C_2 H_6$) in company with hydrogen, and varying quantities of carbonic acid. Coal oil is a very complex mixture, containing members of the olefines, paraffin, acetylene, benzene, and other higher series of hydrocarbons. Thus we find the composition of these different oils are various and complex; and how best to distil or "crack" them, so as to obtain the greatest yield of permanent gases rich in carbon, is the object in view.

The high-temperature process is peculiarly a dehydrogenizing one, at the expense of illuminating power. All the same, a high temperature is absolutely necessary to distil or crack up hydrocarbons containing a large quantity of inert or infusible matter of a mineral nature. Bituminous shale contains a large amount of silicate of aluminia, which absorbs a considerable quantity of heat, and holds the hydrocarbons down until a very high temperature has been attained—in fact, the heat retained by the silicate, at the end of distillation is so great that it pays to obtain the small quantity of residual carbon in the form of water gas by injecting superheated steam. Advantage was formerly taken of this fact in obtaining benzol from gum-benzoin, which when distilled alone yields benzoate, but when mixed with sand, yields benzol, due to the higher temperature. We find the process of ultimate decomposition most nearly realized in the sun's atmosphere, which is made up of the different elementary bodies resolved at this high temperature in accordance with their atomic weights. At a lower temperature—viz., that of the voltaic discharge—the hydrogen would unite with the carbon, to form acetylene; the oxygen, with hydrogen, to form water. From these two compounds, we can obtain most organic bodies: Ethylene ($C_2 H_4$), by hydrogenating acetylene, thus $C_2 H_2 + H_2 = C_2 H_4$; benzol, by keeping acetylene just below a red heat for a long time, $3 C_2 H_2 = C_6 H_6$; naphthalene, by passing benzol or one of its homologues through a tube heated to redness; alcohol, by hydrating ethylene—thus: $C_2 H_4 + H_2 O = C_2 H_5 H O$; and so on. Hence we find present in coal gas, when a very high temperature has been employed, acetylene, hydrogen, benzol, naphthalene, &c.

If we slowly carbonize coal, at a low temperature, the oxygen present will combine with the hydrogen to form water; whilst if we distil rapidly at a high temperature, the water formed, and indeed some of the oxygen not yet combined with the hydrogen, will combine with the carbon, and pass off as carbon monoxide and dioxide. Thus we have a selective property, which varies with changes in temperature. I have examined gases from one retort-house which varied in the course of distillation of the charge of coal from 5 to 10 per cent. in the amount of carbonic oxide present—depending upon the temperature, weight of coal, &c. The higher the carbonic oxide, the lower the watery vapour, and *vice versâ*.

Working on the small scale at high temperatures, I have produced from coal, a gas containing 20 per cent. of carbonic oxide. We might term the nature of the destructive distillation of coal in our retorts a cumulative one, in which we resolve the complex substance coal into carbon. Our object is, of course, to obtain illuminating gas; and this we do, but only to a small extent, compared with the amount of carbon that remains behind. Take woody fibre, for instance, which consists of cellulose, whose minimum formula is represented by $C_6 H_{10} O_5$, we can easily understand that subjected to different temperatures in the retort, also depending upon the mass in comparison with the heated surface, we can obtain various compounds. We notice the hydrogen and oxygen exist in the proportions to form water; and thus we might imagine that cellulose was a hydrate

of carbon, and that it was possible to break the water away, and leave all the carbon—thus: $C_6 H_{10} O_5 = C_6 + 5 H_2O$.

Then, again, take the following table :—

Cellulose Alcoholoids.		Extreme Accumulation.
$C_6 H_{10} O_5$	..	$^nC_6 H_8 O_4$
$^nC_6 H_8 O_4$	..	$^{n2}C_6 H_6 O_3$
$^{n2}C_6 H_6 O_3$	..	$^{n3}C_6 H_4 O_2$
$^{n3}C_6 H_4 O_2$	..	$^{n4}C_6 H_2 O$
$^{n4}C_6 H_2 O$	..	$^{n5}C_6$

The high temperature retort process required in order to partially produce the above reaction, which gives us carbon as the ultimate result, whilst the gentler processes found in Nature give us coal, is modified according to the method of decomposition employed. In our supposed case, the numerical values of the cumulative formulæ are found to increase nearly by powers of "*n*." Hence one can understand that, as the temperature increases, the remaining bodies are split up into lower bodies, rich in carbon and free hydrogen; and, further, that they are liable to vary in the kind of decomposition at various temperatures, &c. For this reason, we find the number of bye-products and subsidiary reactions increase more slowly towards the end of distillation. Similar conditions hold good for all bodies susceptible to cumulative resolution; and hence we find homologous series present in coal tar.

It is easy to understand, from what has been said, that it is impossible to convert the whole of the denser oils and solid hydrocarbons into permanent gas without any residual carbon —containing, as they do, such an excess of carbon in proportion to the hydrogen present; and certainly the next best thing to do is to subject the hydrocarbons or oils to the conditions under which the hydrogen will retain the greatest amount of carbon; resulting in the production of a permanent gas insoluble in water—one which, under moderate changes in temperature and pressure, is not liable to be deposited in the mains and services.

We have for this purpose a well-known series of compounds, which we will take as an illustration of our meaning. The paraffin series or group—which begins with marsh gas or methane, and is represented by the general formulæ $C_n H_{2n+2}$; the olefines, $C_n H_{2n}$; and acetylenes, $C_n H_{2n-2}$. The series containing the greatest quantity of carbon gives the highest illuminating or sperm value, when complete combustion takes place, and hence are the most valuable for enriching purposes. Looking over our three groups, we find the compounds represented by the formulæ $C_n H_{2n-2}$, the richest in carbon; the next, $C_n H_{2n}$; the least, $C_n H_{2n+2}$. Between these three, we have a gradual increase of hydrogen. The first group are difficult to produce, as they require high temperatures, which set up, in attaining to it, subsidiary reactions, resulting (as before stated) in the formation of a large number of bye-products, which are soluble in water, are liquid or solid, at ordinary temperatures, or are low in illuminating or sperm value. These conditions agree with our methods of distilling coal; and hence we find acetylene, three molecules of which combine, as the temperature increases, to form benzol, and this as the temperature further increases forms naphthalene, &c. The third series or group of bodies have a good illuminating value among the higher series, which unfortunately are liquid at ordinary temperatures, as benzol or benzene, toluene and xylene. The first of the series of group, marsh gas, $C H_4$, might be termed non-luminous; the next, ethane, $C_2 H_4$, slightly luminous; and so on, until we reach the bodies having a high illuminating value, such as butane, pentane, hexane, &c. The lower or gaseous bodies of the second group have a high illuminating value, and are easy to produce under conditions of temperature recognized by the patentee of the Peebles process. They are nearly insoluble, both in oil and water, and hence offer the greatest measure of success.

We can easily understand that, as the oil passes through the retort, the lighter hydrocarbons are at once cracked up into permanent gases. The heavier hydrocarbons are simply vapourized; and, carried forward by the stream of permanent gases, they would in the ordinary course become condensed in the form of tar oils when subjected to the ordinary reduction in temperature. Hence they would be lost; but in the Peebles low-temperature process they come in contact with the oil flowing into the retort, and are at once condensed and carried back. Herein lies the great point of difference which is proving so successful.

We here avoid, as far as possible, the production of gases of the paraffin series. They are, for the most part, soluble in oil; and they thus become liable to over-cracking on their being constantly returned to the retort, and thereby produce gases having a low illuminating value. These gases are peculiar to the high-temperature industry. The olefines, from $C_2 H_4$ to $C_4 H_8$, are permanent gases of high illuminating value; and to my mind they are the series of gases to aim at producing in cracking-up oils. These valuable hydrocarbons are produced in largest volume by subjecting the oil to a low temperature. In the Peebles process, the cracking up of the oils is carried only so far as to produce those hydrocarbon gases in which the greatest quantity of carbon is united with hydrogen. This is compatible, of course, with the production of a gas or gases of high sperm value, insoluble in oil and water, not liquefied under any ordinary changes in temperature and pressure. As it is impossible, from the nature of the process, for any carbon in the form of soot to be carried away, and further as the process does not produce anything in the nature of tar, by taking the weight of gas produced, together with the coke left in the retort, we obtain the quantity of oil employed, *plus* a slight loss. We therefore need not be surprised to learn that this process leaves more coke than has been before obtained.

There can be no doubt that fractional distillation is the correct method. One has only to remember that we are dealing with a substance composed of a mixture, for the most part, of fatty hydrides, having different boiling-points, and it is easy to understand that the temperature employed, must vary to suit these different hydrocarbons, so that the lighter ones are not over-cracked, and reduced to hydrogen, methane, &c.; also that the heavier ones are sufficiently cracked-up by easy stages. In arriving at the temperature best suited to any particular oil, we must consider its density. From this it will be found a very easy matter to arrive at the required temperature for cracking up into a rich and permanent gas. Analysis of the gas made by the Peebles process shows it to be composed of hydrocarbons belonging to the olefiant series ($C_n H_{2n}$); therefore it is for us to produce the largest volume of those higher series of gases, which are permanent under ordinary conditions of temperature and pressure. We must look upon our oils as hydrocarbons containing so much hydrogen combined with excess of carbon; and how best to crack them so as to produce a permanent gas insoluble in oil and water, is the problem before us. That residual carbon must remain, is certain, whenever the heavier-grade oils are employed. The weight of residual carbon will, of course, vary with the density of the oil employed. The greater the density of the oil, the more residual carbon will there be; the lighter the oil, the less residual carbon. Tar, and carbon in the form of soot, are to be avoided as so much waste, besides being unscientific. As to stratification of gases, is it not rather due to the presence of those light oils which are carried along by the permanent gases, than to the actual difficulty of mixing those gases having some well-known and determined composition? All the same, supposing the gases from the coal and oil are brought together at the inlet to the purifiers, this difficulty vanishes at once; because, when thoroughly intermixed, layering or stratification will not take place. That light oil vapour can be carried along by the permanent gases was fully proved to me, during my journey through the States, where in a great many places I noticed the burners had an oily appearance. The main syphons contained a large quantity of oily condensation at a considerable distance from the works. In some cases, the burners had the appearance of having been dipped in oil. This proved, of course, two things—viz., that the burners in the first place were not suitable; and, secondly, that the oil had been vaporized, and not cracked up into a permanent gas, or had been over-cracked, as I found was the case wherever the process was conducted at a high temperature, producing large quantities of benzol. This state of affairs was specially observable wherever oil gas was exclusively employed.

It is worthy of notice, in passing, that aromatic hydrides ($C_n H_{2n-6}$) are not produced in any of the low-temperature methods, only in very minute quantities; and to this extent the products from the high-temperature industry might be recognized by the presence of these aromatic hydrides. We find American and Russian petroleums contain the greatest amount of liquid products having a low boiling-point. These, no doubt, have been produced by the long-continued action of a very gentle heat. Further, we get traces only of those compounds which are produced at a high temperature—viz., aromatic hydrides—and naphthalene, which is not found in petroleum. Petroleum contains both hydrogen and the fatty hydrides ($C_n H_{2n+2}$) from CH_4 to $C_5 H_{12}$, in solution. These are gases or vapours at ordinary temperatures; and hence they have to be removed. If allowed to escape, they would mix with the air, and furnish a highly explosive mixture. Petroleums are found to vary very much in composition; but for most practical purposes it is sufficient to ascertain the specific gravity as a guide to working them successfully.

With respect to finding the illuminating power of rich gases (which means gases rich in carbon), they must be diluted with non-luminous gases, or a poorer coal gas, or, if not too rich, consumed at a less rate than 5 cubic feet per hour in a flat-flame burner, or an Argand burner with a taller chimney, and calculated to the 5 cubic feet rate. In all cases, a clear, steady, and non-smoky flame must first be obtained—not very small, or the cooling effect of the burner will give results much too low. Rich gases require more oxygen for their complete combustion; and, further, the light-giving value of a rich gas is increased up to a certain point by the addition of hydrogen, methane, carbonic oxide, or other non-luminous gas. The greatest illuminating power is obtained when all the carbon particles are heated to whiteness first and consumed afterwards. It is the special character of hydrogen, methane, carbonic oxide, &c., to produce, by their rapid combustion, a high temperature. Therefore, when a gas rich in carbon is mixed with these non-illuminants, they produce by their rapid combustion a temperature sufficiently high to render the carbon particles incandescent. Thus we obtain a higher illuminating power. All the same, I scarcely consider it sound reasoning, when a rich gas tested alone has only (say) 60-candle power, but when it is mixed with a poorer gas, such as hydrogen, has 90-candle power, to say that 60 candles

is its true photometric value. It is rather that, in the first case, we do not obtain the highest efficiency of the hydrocarbons present. Therefore I think it would be more accurate to say that this difference is so much candle power loss, due to imperfect combustion. It would be much better to speak of the photometric value of a rich gas as that which was obtained when all its carbon particles did duty in producing its quota of light. Methane is composed of one atom of carbon combined with four atoms of hydrogen. The heat produced by the combustion of this hydrogen is not sufficient to render the carbon incandescent under normal conditions. Hence we do not obtain light. Again, the great quantity of water vapour produced also prevents the temperature from rising sufficiently high. Take olefiant gas ($C_n H_{2n}$). Its complete combustion is shown as follows:—

$$C_2H_4 + 3\ O_2 = 2\ CO_2 + 2\ H_2O.$$

In this case we have twice the amount of carbon. Hence we get one atom heated to whiteness (or rather dull red), and light produced; and so on up the scale, until from a gas that furnishes light we pass on to those heavier gases that give off smoke when consumed in ordinary burners. This is due to the large amount of carbon present. The hydrogen first combines with the oxygen of the air, and leaves the carbon, which, being set free in large quantity, is carried away in the form of soot, owing to the heat produced by the combustion of the hydrogen, and some carbon being insufficient to heat the carbon particles to a state of incandescence. Clearly, then, we must raise the temperature of the flame. But how? Simply by the addition of hydrogen or other poor gases; so that the heat produced by the combustion of these gases is sufficient to raise the carbon particles to a state of incandescence. When this is attained, we are obtaining the greatest possible amount of light from the gas itself. There must consequently be a limit where the further addition or reduction of these poorer gases must be detrimental to the highest results being obtained. The reason for adding oxygen to the oil gas made by the hydro-oxy process is simply to increase the rapidity of combustion, which gives us a higher temperature, and in this way renders the carbon incandescent, in the same way that the air from a pair of bellows makes a fire glow more brightly at the expense of a greater consumption of fuel.

Summing up the high and low temperature methods, and putting the results side by side, we find the high-temperature method of cracking-up oils results in the production of carbon in the form of soot, which is practically useless; some tar oils containing large quantities of benzol; and a gas, the illuminating value of which depends upon easily condensable hydrocarbons, and therefore rapidly deteriorates when subjected to low temperature or pressure. Thus, starting with soot, we get: C (solid and useless), CH_4 and C_2H_6 (gaseous), H and C_2H_2 (gaseous), C_6H_6 (liquid), C_2H_4 (gas), and $C_{10}H_8$ (solid), &c. The low-temperature industry produces a different set of reactions, and the series are more regular; the illuminating value of the gas depending not upon easily condensable hydrocarbons, but upon a well-known series of rich and permanent gases belonging to the olefiant group of bodies ($C_n H_{2n}$), such as ethylene (C_2H_4), propylene (C_3H_6), butylene (C_4H_8), &c., and the only residual product being a valuable coke, hard and compact, usually very free from ash and sulphur—depending, of course, upon the oil employed. Such a gas as the above would not deteriorate when subjected to the lowest temperature or pressure found in ordinary working. This low-temperature process gives a series of reactions which are far more favourable to success than we can ever hope to obtain from the high-temperature method.

I think I have clearly proved the greater value of the low, as compared with the high temperature method of cracking-up oils, to obtain a rich and permanent gas.

Midland Association of Gas Managers.—The autumn general meeting of this Association was held last Thursday at the Grand Hotel, Birmingham—Mr. B. W. Smith, of Smethwick (the President), in the chair. A general notice of the proceedings appears in another column of the JOURNAL to-day; and it is here only necessary to refer briefly to the formal business that engaged the attention of the members in the early part of the day. This consisted of the election of two new members—Mr. P. H. Fletcher, of Evesham, and Mr. W. H. T. Norfolk, of Leek, —and the officers for the ensuing year. In a few well-chosen words, Mr. Smith proposed the election of Mr. R. O. Paterson, of Cheltenham, to the position of President—referring to the two previous occasions on which Mr. Paterson had held that office, with great advantage to the Association. Mr. Peter Simpson, of Rugby, seconded the nomination; and it was agreed to by acclamation, and suitably acknowledged by Mr. Paterson. Mr. George Winstanley, of Coventry, was elected Vice-President. Mr. Simpson was re-elected Treasurer, and Mr. Meiklejohn was re-appointed to the office of Secretary; both being heartily thanked for the energetic way in which their duties had been performed during the past year. Mr. C. Dakin, of Cradley Heath, and Mr. E. L. Adlington, of Worcester, were elected on the Committee, in place of the members retiring; and Messrs. Brookes and Young were appointed Auditors. Votes of thanks to the President and other officers for their services during the past year were then adopted; and the proceedings of the meeting were brought to a close.

TECHNICAL RECORD.

THE DEVELOPMENT AND TRANSMISSIONS OF POWER FROM CENTRAL STATIONS.

In the JOURNAL last week we gave an abstract of the first of the lectures on the above subject delivered by Professor UNWIN at the Society of Arts early in the present year. We now deal with the second lecture, which was devoted to the question of the storeage and development of energy by water power.

The lecturer began by saying that, in most applications of the energy derived from fuel, the fluctuation in the demand for power involves waste. It is in steam central stations, however, which have to work during 24 hours, in the course of which the demand varies considerably, that the waste due to irregular working has been most serious. Of all central stations, those established for the supply of electricity have to meet the greatest fluctuation of demand for energy; and the waste so occasioned has compelled electrical engineers more than any others to seek for means of storing energy. The distribution of gas, he went on to remark, is not strictly a distribution of energy, but only of the means of conveniently obtaining it. A gas lighting distribution, however, is analogous to a distribution of energy; and the demand varies nearly as much as in an electrical distribution. The gas engineer is happy in having a convenient and cheap means of storeage. Taking 25 cubic feet of gas as capable of yielding one effective horse-power-hour of energy, it appears that gasholders cost about 5s. 6d. per effective horse power stored. Mr. Trewby puts the cost of gasholders at a London station at £10,000 per million cubic feet of gas supplied per day. In that case, such a station works virtually at 1666 effective horse power; and the cost of the gasholders is £6 per effective horse power, reckoned on the average rate of supply throughout the year. Here, allowing 10 per cent. for interest and depreciation, the storeage adds about 12s. per effective horse power to the annual cost. The electrical engineer would be glad to have a means of storeage equivalent to a gasholder. For a time it was thought that such an equivalent had been found in the storeage battery. But the use of these appliances is limited to continuous-current systems; and moreover, they have certain practical defects. In the first place, the maximum rate of discharge is limited; and, secondly, about one-fifth of the energy stored is wasted. The cost of storeage batteries prohibits their employment on a large scale; but used in a limited way they serve some useful ends.

Passing on to consider the cost of accumulator or battery storeage, Professor Unwin made the following remarks: From data given me by Professor Ayrton, it appears that Epstein cells, tested in the laboratory, would work at 1-horse power, and store a charge for 2¼ horse-power-hours. The cells cost, without allowance for buildings, insulation, or switching arrangements, or for waste of energy, £20. That is, the bare cost of the cells amounts to £20 per horse power reckoned on the maximum rate of working, or to £8 per horse-power-hour stored. Suppose a station working at an average of 500-horse power, the maximum demand in the 24 hours would be 2000-horse power, of which 1500-horse power would have to be supplied from the battery. The cost of the battery to supply energy at the necessary rate would be £30,000. During 24 hours the quantity of energy supplied would be 12,000 horse-power-hours, half of which must be stored. Batteries of sufficient capacity would cost £48,000. Here the latter condition determines the cost. Taking interest at 5 per cent., and maintenance and depreciation at 12½ per cent., the annual cost of the battery would be £8400, or nearly £17 per horse power of average rate of working of the station. This is the bare cost of the cells, without buildings, adjuncts, or reserve. In a project for lighting Frankfort-on-the-Main, Mr. Oskar von Miller and Mr. Lindley provided large secondary battery stations. The batteries had a capacity of 11,700 ampère-hours, and were capable of supplying a current of 3500 ampères at 100 volts. The batteries, with wood platforms, insulation, &c., were taken to cost £25,100; and the buildings for them, £11,600. This is equivalent to a capital cost of £23 per horse-power-hour of storeage capacity, or £78 per horse power reckoned on maximum rate of working.

Professor Unwin next dealt with Mr. Druitt Halpin's proposed system of thermal storeage, which, he said, appeared in many respects to meet the conditions required. His plan is to communicate heat in boilers to a body of water stored in reservoirs under pressure. From the reservoirs steam is taken through a pressure-reducing valve exactly when and in what quantity it is required. Mr. Halpin proposes that the heat reservoirs should be under a pressure of 265 lbs. per square inch (absolute) when fully charged; the corresponding temperature being 406° Fahr. He proposes that the steam-engines should be worked at 130 lbs. per square inch, corresponding to 347° Fahr. The total heat stored when the reservoirs are fully charged is the difference of the total heat of the water at 406° and 347° Fahr., or the heat due to a range of temperature of 59°. Every pound of water falling in temperature through this range will yield 61 thermal units of heat. But the total heat required to generate 1 lb. of steam at 130 lbs. per square inch from water at 347° Fahr. is 868·8 thermal units. Consequently, 14¼ lbs. of water falling in temperature from 407° to 347° will yield 1 lb. of

steam. To allow for radiation, loss, and imperfect working, this may be taken at 16 lbs. of water per pound of steam. A simple cylindrical reservoir, 8 feet in diameter and 30 feet long, will contain 84,000 lbs. of heated water. Such a reservoir would be capable of generating, under the conditions supposed, 5250 lbs. of steam at 130 lbs. per square inch. The steam consumption may be taken to be, per effective horse power, 18 lbs. per hour in condensing, and 25 lbs. in non-condensing engines. Hence one such reservoir would store per hour 286 effective horse-power-hours if the steam is used in condensing-engines, or 210 effective horse-power-hours if employed in non-condensing engines. If the reservoir were fully charged and discharged daily, it would yield 104,400 and 76,660 effective horse-power-hours of stored energy yearly in the two cases. A reservoir 30 feet by 8 feet would cost erected, with ample allowance for buildings and appendages, £470. As it is not exposed to fire, its deterioration would not be considerable; and 10 per cent. would be sufficient to cover interest, maintenance, and depreciation. Hence the first cost of such reservoirs per horse-power-hour, reckoned on their storeage capacity, and the annual cost per horse power added to stored energy by the cost of storeage, would be as follows: Condensing plant, £1·64 and £3·94; non-condensing plant, £2·24 and £5·37. The £3·94 and £5·37 represent the cost due to 8760 effective horse-power-hours annually. Mr. Halpin's plans appear to be practicable, and to promise considerable economy in stations where the load fluctuates greatly; but there are details of working involving difficulties which must be met.

The lecturer then explained the arrangement of thermal storeage reservoirs on Mr. Halpin's plan, and gave an example of a station worked in the ordinary way and with these reservoirs. Mr. Halpin takes the case of an electric lighting station where, with the normal mid-winter load, the daily output is 15,600 effective horse-power-hours, or the mean rate of working 650 effective horse power. In ordinary conditions, without storeage, engines and boilers capable of working to 2400-horse power would be required during the short period of maximum demand. With thermal storeage reservoirs, the boilers would be of 650-horse power only; but, on the other hand, reservoirs must be provided, capable of generating all the steam required in excess of 650-horse power, when the demand exceeds that amount. He estimates that 5900 effective horse-power-hours would meet the whole demand in excess of the mean. Taking 16 lbs. of heated water to supply 1 lb. of steam, 360 lbs. of water stored would generate steam enough for an effective horse-power-hour. Then the tanks must contain 900 tons of water; 24 tanks 30 feet by 8 feet would have sufficient capacity. Without storeage tanks, there would be required eight boilers, each with 2000 square feet of heating surface, and two boilers in reserve; and the cost of the ten boilers, with erection, pipes, and pumps, would be £10,300. With tanks, two similar boilers and one in reserve, and 24 tanks would be necessary; and the cost, with erection, pipes, pumps, &c., would be £15,000. The expense of the plant is greater by £4700 with the tanks. Taking interest and depreciation at 10 per cent., this would correspond to an annual charge of £470, or about the value of 470 tons of coal at London price. But if the saving of waste by having boilers regularly, instead of irregularly, worked, were only ½ lb. per effective horse-power-hour, the annual saving of coal would be 1270 tons.

The remainder of the lecture was devoted to the subject of water power; and the following are extracts from Professor Unwin's remarks thereon.

Where there exists a natural waterfall, with a considerable and regular flow, and where local conditions are favourable for the construction of the necessary works, water power is generally cheaper than steam power. The water costs little or nothing; the expenses of maintenance and superintendence are small; and the power is regular, controllable, and convenient. In such cases, the annual cost of the power consists almost entirely of interest charges on the capital expended in works and machinery. With some exceptions, water power is at present utilized in the neighbourhood of a natural waterfall; and the usual means of transferring the power of the fall adopted up till a recent period has been the conveyance of the water itself in canals and pipes. But a more convenient and cheaper means of transmission would greatly increase the availability of water power; and the relative importance of steam and water power would, in some countries, be very considerably changed. It appears, from a report by Mr. Weissenbach, that in 1876, 70,000-horse power derived from waterfalls were applied in manufacturing in Switzerland. Probably the amount now employed is at least 80,000-horse power. It is estimated that the total available water power in Switzerland amounts to 582,000-horse power. Putting the annual value of a horse power at £6, this represents a sum of £3,500,000. Used to replace steam power, it would save annually 1,250,000 tons of coal. It is stated that at the present time Switzerland pays £800,000 annually to other countries for coal. Nearly the whole of this expenditure could be saved if its natural wealth of water power was utilized. The recognition of the importance of this supply of power is exciting great interest in Switzerland; and there is hardly an important factory which is not either using it or making preparations or surveys with a view of doing so.

The utilization of water power often involves the construction of large permanent works, such as river dams, reservoirs, and canals. Mr. Emery estimates that at Lawrence, in the United States, £200,000 was spent on works, independent of the hydraulic machinery; and a still larger sum at Lowell. Such extensive works can be best executed by an association in the interest of many consumers. Thus is created a water-power company, who establish what is virtually a central water-power station and a distribution of power at a rental to consumers. In the American cases, the water itself is distributed in canals to consumers at a level permitting the creation of a waterfall at the mill or factory. But in certain other cases, a further step was taken; the water-power company utilized a natural fall, and erected the necessary turbines, and then transmitted the power in the form of mechanical energy to consumers. Installations of such a kind, now of a quite respectable antiquity, were erected at Schaffhausen, Freiberg, Zurich, and Bellegarde. In these cases the method of transmitting power adopted, admirable as it was, had limitations, and the extension of the works was restricted. Now that there are new means of transmission, the Schaffhausen and Zurich power-generating stations are being increased, and a new and remarkable installation has been erected at Geneva.

The original project for utilizing the motive power of the Rhone at Geneva, partly for pumping a supply of water, and partly for motive power for industry, comprised 20 turbines of 300-horse power each, or an aggregate of 6000-horse power. Of these 14 were at work in 1892. Four more of somewhat larger size will, it is expected, be constructed by 1898. When these are at work, the whole available water power in Geneva will be utilized. But it is foreseen that the demand for power will not then have been satisfied. The total receipts for the installation reached £22,500 in 1891, and were increasing £2200 annually. The Municipality of Geneva have determined to provide for future demands; and plans are being studied for utilizing 12,000-horse power at a point on the Rhone six kilometres below Geneva, whence the power will be distributed electrically. At Biberest, near Soleure, MM. Cuenod, Sautter, and Co. have utilized 360-horse power, and transmitted it 28 kilometres electrically. At Genoa, water power due to surplus fall along a line of water-main has been utilized at three stations. The greater part of the energy is transmitted to Genoa for electric lighting and power purposes.

These are cases where water power has been utilized and distributed, which are actually in operation; but there are many other schemes projected. One is for utilizing 10,000-horse power on the Drause, near Martigny; another to utilize 20,000-horse power at a point 17 kilomètres above Lyons. In Sweden, there is a project to transmit power from the Dal River Fall, at Mansbo, to the Norberg mining district, a distance of 10 miles; another, to transmit the power of the Strup Waterfall on the Judal River, to the town of Ostersund, a distance of 11 miles. Projects for utilizing the Falls of Trollhatan and the River Motala to supply power to Gothenburg and Nord Koeping have also been studied.

It is in the United States of America that water power is most largely used, where it is in most direct competition with steam power, and where data for a comparison of their relative advantages can best be obtained. The money value of the water power utilized in the United States is very considerable. From the returns of the Tenth Census, it appears that in 1880 there were 55,000 water-wheels and turbines, of an aggregate of 1,250,000-horse power. At £5 per annum, the water power utilized is worth £6,250,000 a year. The comparison of the relative amount of water and steam power is interesting. Taking the whole of the United States, 36 per cent. of the power used in manufacturing was at that date water power, and 64 per cent. steam power. In certain industries, the proportion of water power was greater. In the manufacture of cotton and woollen goods, of paper, and of flour, 760,000-horse power derived from water, and 515,000-horse power derived from steam, were employed. In New England there are five water-power stations, where more than 10,000-horse power is utilized during working hours, and thirteen where more than 2000-horse power is used. The water is distributed to millowners, who construct the turbines and pay a rental proportional to the amount of water used. The earliest application of this system was at Paterson, New Jersey, where the Passaic River furnishes about 1100-horse power night and day. At Lowell (Mass.), the utilization of the water power began in 1822. The Merrimac River has a fall of 35 feet, and furnishes, at the maximum, about 10,000-horse power during the usual working hours. At Cohoes, in the State of New York, the Mohawk River has a fall of 105 feet. It could furnish about 14,000-horse power during working hours; but it is only partly utilized at present. At Manchester, New Hampshire, the Merrimac has a fall of 52 feet, and furnishes, at the minimum, about 10,000-horse power during working hours. At Lawrence (Mass.), the Essex Company built a dam forming a fall of 28 feet, and obtaining a minimum of 10,000-horse power during working hours. At Holyoke, the Hadley Falls Company built a dam forming a fall of 60 feet, and rendering 17,000-horse power available during working hours.

In some cases, local conditions are so favourable that water power can be developed at an almost nominal cost. In others, unforeseen contingencies have led to expenditures which have made the cost excessive—greater, in fact, than that of steam power. Mr. Swain, in a paper read before the American

Statistical Association in 1888, puts the average cost of steam power in the States, in favourable localities, at £4, and that of water power at about £2 per horse power per annum. Both of these estimates are so low that it may be suspected that they are based rather on the nominal power of the plants than on the average actual horse power used throughout the year. The cost of water power, however, varies greatly. Mr. Swain states that, while in the North-West the cost for interest, depreciation, and water-rental is from £2·2 to £2·5 per horse power per annum, in New Jersey it is from £12 to £15. That water power is used at all, at a cost so high as this, proves that it has advantages of convenience compared with steam power which balance some excess of cost.

It is somewhat difficult to arrive at a precise knowledge of the cost of water power in the great works in America, because of the gradual way in which they have been developed, and the want of complete data as to the amount expended. Mr. C. E. Emery,* who is probably rather prepossessed in favour of steam power, has made the following estimate of the cost of water power at Lawrence. He puts the total cost of the structural works at £200,000, and the power utilized as equivalent to 13,000-horse power for ten hours daily throughout the year. This makes the cost of structural works £15·4 per horse power. The cost incurred by the millowners in erecting turbines, sluices, &c., he puts at £9 per horse power of the turbines, or £13 per average horse power actually utilized; the turbines being generally constructed to yield surplus power in times of emergency. This makes the total expenditure £28·4 per average horse power, utilized ten hours daily throughout the year. He allows 2½ per cent. for depreciation, 1¼ per cent. for repairs, 1¼ per cent. for taxes, 10 per cent. for interest, and 2 per cent. for working expenses, or, altogether, 17 per cent. on the capital expenditure. This makes the annual cost of a horse power at Lawrence £4·7 per annum, which he takes to be about the same cost as that of steam power, with economical engines and coal at from 8s. to 12s. a ton. No doubt, however, in many cases water power can be obtained at a less cost than that incurred at Lawrence. It appears that at Geneva, for the first groups of turbines erected of 840-horse power, and for the river works then completed, the capital cost amounted to £60 per effective horse power. The groups of turbines subsequently erected have cost only £19 per horse power. The mean expense, when the present works are completed, will amount to £27 per effective horse power. In this case the water does not cost anything. If we allow 5 per cent. for depreciation, repairs, and working expenses, and 10 per cent. for interest on capital, the cost per horse power per annum will amount to only £4. In the new works below Geneva, where 12,000-horse power are to be utilized, it is estimated that the whole cost for turbines and structural works will come to £60 per horse power for the first 2400-horse power. When the whole installation is completed, the capital cost will be only £27 per horse power.

The need of storing power derived from waterfalls arises out of different considerations from those which apply in the case of steam power. In the case of water power, nearly the whole cost is due to interest and depreciation on the permanent works, machinery, and structures; scarcely anything being due to daily working expenses. With steam power, only about one-third or one-half the cost is due to permanent charges, and two-thirds to one-half arises out of wages and fuel. If the engine stops for 12 hours out of the 24, coal and wages are saved; and though the cost per horse power is greater, it is only moderately increased. But if water-power machinery stops for 12 hours out of the 24, there is no sensible diminution of working expenses, and the cost per horse power is doubled. At some American water-power stations, an inducement is held out to consumers to work day and night, by charging a lower rate for power at night. In other cases, the difficulty is met by storing the night water to be used by day, so that the amount of power which can be supplied during working hours is doubled. One of the characteristic advantages of water power, as compared with steam power, is that the former permits the storeage of energy by means not costly or difficult. It is the facility of storing energy by raising water to elevated reservoirs which, in some cases, makes it profitable to pump water to be used afterwards for power purposes. There are two distinct methods of storing energy in hydraulic systems—viz., accumulation storeage and reservoir storeage. The hydraulic accumulator is simply a vertical cylinder with a heavily loaded plunger, into which the water is pumped till it is required, and from which it is discharged by the descent of the plunger. What makes the accumulator important is that its rate of discharge is very great. It is superior to the secondary battery in that the rate of supply of stored energy is not limited. If a suitable site can be found, reservoirs can be built of very large capacity at a moderate cost per cubic unit stored.

At both Geneva and Zurich, very remarkable and extensive systems for utilizing and distributing water power have been for some time in successful operation. Data may be taken from the Geneva installation, though the works in both cases are similar, and both have been financially successful. At Geneva, the Rhone flowing out of Lake Leman has, by skilful arrangements, been made to afford a clear fall, varying from 5½ to 12 feet. There have been erected on this fall 18 low-pressure turbines, giving an aggregate power of over 4000-horse power. These turbines are used, primarily, in pumping a supply of water for Geneva; but since 1871 there has grown up a system of using water from the town mains for motor purposes.

When the electric installation was erected, and driven by turbines actuated by the pumped water, the necessity of storeage became evident. At 4 kilomètres from Geneva, a site was found, at an elevation of 390 feet above the lake, where a reservoir could be constructed. The reservoir contains 453,000 cubic feet; and therefore stores 5573 gross horse-power-hours of energy. Allowing for the loss at the motors driven by the water, the effective energy stored may be taken at 4180 horse-power-hours. The reservoir is a covered one of expensive construction; but its cost does not exceed £2·4 per horse-power-hour of energy stored. It is a work requiring little maintenance; and it hardly adds 3s. per annum to the cost of a horse power supplied. On the other hand, the energy stored would without it have gone to waste; and for this a rental is obtained of £8 per annum. There is now in London an admirable systemof hydraulic power distribution perfectly adapted to the special purposes to which it is applied, and mechanically and financially successful; but it is a system of limited applicability. Large as it is, the number of renters of power is less than 2000; and the maximum pumping capacity of the stations at present erected is 1500 effective horse power. In the comparatively small town of Geneva, with one-eightieth of the population of London, there is a system of power distribution as large, and of more varied usefulness than the one in use here. There were there, three years ago, 137 motors, aggregating 280 effective horse power, on the low-pressure mains, and 79 motors, aggregating 1284-horse power, on the high-pressure mains. The power is distributed to ordinary consumers at one-eighth, and for the electric lighting at one-twelfth the London price. Perhaps it is fair to add that in London there are 2500 gas-engines, which represent a considerable aggregate power, virtually supplied from a central station. Nevertheless, motive power is more generally, and more cheaply, distributed in Geneva than in London. No doubt local conditions have favoured this. Perhaps the advantage of cheaply distributed power has not yet been fully recognized in London; and when this has been better understood, means may possibly be found to make motive power a purchasable commodity.

In his third lecture, Professor Unwin dealt with the subject of the transmission of power by wire-rope cables.

The lecturer began by referring to the introduction of telodynamic transmission by Hirn, at some large factories at Logelbach, near Colmar, in Alsace, in 1850; and he then proceeded to give a general description of the system. Not long after the invention of Hirn's method of wire-rope transmission, and its application at Logelbach, an opportunity occurred for trying it on a more extensive scale at Ober-Ursel, near Frankfort, to utilize the water power of the Urselbach. There was also an installation at Ochta, near St. Petersburg, in 1864; and, soon afterwards, a more considerable application of the system at Schaffhausen. The lecturer gave full descriptions of these works, as well as of those established at Tortona, in Italy, at Fribourg and Bellegarde, in Switzerland, and at Gokak, in India; and then summed up the advantages and disadvantages of the telodynamic system as follows.

The telodynamic system is adapted for transmitting and distributing power to distances of a mile or more, which are large compared with the distances to which power is ordinarily transmitted by shafting and similar means. On the other hand, it cannot seriously compete with electrical transmission in cases where the distance to be covered is reckoned by many miles. With this limitation, it may be noted: (1) It has the peculiar advantage that it transmits the mechanical energy developed by the prime mover directly, without any intermediate transformation. In electrical distribution, a double transformation is necessary—a transformation into electrical energy by a dynamo and re-transformation into mechanical energy by an electric motor. This double transformation involves waste of power, and increase of capital. (2) The efficiency of transmission to such distances as those at Schaffhausen is undoubtedly very great. It is uncertain whether a similar amount of power could be distributed to an equal number of consumers electrically with as little waste of energy in the process. (3) The telodynamic transmissions which have been in operation, some of them since 1864, have actually worked continuously, without serious stoppage, and have only failed to return an adequate profit where they were undertaken on a scale too large for the amount of industry requiring to be supplied with power in the locality. (4) Where, as at Bellegarde and Fribourg, the power station is 150 or more feet below the factories driven, the telodynamic system has an advantage over some systems, such as the hydraulic system, that there is no loss of efficiency due to difference of level.

On the other hand, it may be admitted that telodynamic transmissions, simple as they are mechanically, involve considerable cost. The pulley piers require to be lofty, and strongly built. The maximum length of span hitherto accomplished is 630 feet, at Bellegarde. Experience has also shown that the cost of maintenance is considerable. The cables must be

* "The Cost of Steam Power." Trans. Am. Soc. Elect. Eng., March, 1893.

replaced annually; and experienced workmen are necessary to make the long splices in the ropes. One distinct disadvantage of the telodynamic system is that no means have been found of directly measuring, by numerous or continuous observations, the amount of power delivered to each consumer. So long as the power is distributed to very few consumers, it is possible to assess, with practical fairness, the charge to each, without such measurements of the power. But, in proportion as the consumers are more numerous, the defect of the system in this respect becomes more serious. A recording transmission dynamometer would, of course, obviate the difficulty; but the cost of such an appliance is considerable.

It is, in some cases at any rate, a defect of the cable system that the amount of power which it is practically possible to transmit by a single cable is limited. It is not possible, by increasing the size of the cable, to transmit an indefinitely large amount of power. The cables become too heavy to be manageable, and the pulleys too large in diameter. In the report of the experts advising the town of Geneva, in 1889, the limit for one cable was placed at 100-horse power. Messrs. Rieter Bros. place it at 300-horse power; and this amount has, in fact, been transmitted. No doubt the proper limit varies in different cases. It is also an inherent characteristic of the cable system that the efficiency decreases rapidly when the distance increases beyond certain moderate limits. On the most favourable interpretation of the experiments, the efficiency may be 0·96 for 100 yards, or 0·93 for 500 yards—efficiencies remarkably high. The efficiency, however, falls to 0·60 for 5000 yards—an efficiency by no means remarkably good.

The remaining lectures will be noticed in subsequent issues.

THE ARTIFICIAL LIGHTING OF WORKSHOPS.

At the Meeting of the Institution of Mechanical Engineers last Wednesday, a paper on the above subject was read by Mr. B. A. Dobson, of Bolton.

In the course of his introductory remarks on the necessity for the extensive use of artificial light in manufacturing districts, owing to the usually prevalent gloom, the author remarked that in his own works at Bolton, for four years in succession, it had occurred that on the 21st of June—the longest day—the gas in every room, amounting to nearly 7500 jets, had to be lighted by eleven o'clock in the morning, and remained lighted until work ceased. This had, he said, occurred also in other towns, and in weather which ought to have secured abundant sunshine. To such an extent did gloom prevail, that in clear weather the effect of bright sunlight became even distressing to the eyesight, simply from the rarity of the contrast. He then proceeded to set forth the requirements for a well-lighted workshop. In the first place, the light, if artificial, should be sufficiently intense to give the power of clear and natural sight over any portion of the work; and it should be so diffused as to avoid casting shadows, or placing one part of the work in too great relief as compared with the general tone of the whole. Then the light should be of such a character as to have no tendency to injure the sight by a blinding glare; it should leave the atmosphere free from noxious emanations; and it should not unduly raise the temperature of the room in which it is employed. Lastly, the light should be simple, and capable of easy control; and its cost should be kept within such limits as will render it practicable for those who have to make their livelihood in their special trade in open competition with the rest of the world.

Mr. Dobson next dealt with the electric lighting of workshops by inverted arc lamps and by incandescent electric lamps. With regard to the former, he said he made a few experiments, and found it was possible with these lamps to see into the interior of the machines, and even underneath them, in a way which would previously have seemed incredible; and, moreover, it was not possible to make a shadow. A machine-room, 345 feet long, 76 feet broad, and only 12 feet high, containing 239 machines tended by 200 workpeople, was furnished by incandescent electric lamps fitted on the ordinary gas-brackets. Within a week after these lamps were put up, the importance of the requirement with regard to glare was amply justified, for nearly every workman had devised a shade of one kind or another. However, the atmosphere was improved, as, eventually, was the general health of the workmen. The author was nevertheless dissatisfied with the lighting; and he therefore substituted four inverted arc lamps for the 26 incandescent lights employed in the darkest portion of the shop. The result was the production of a temperate light, equal in all parts, instead of a light concentrated upon its own work. This was so encouraging as to induce the author to make an experiment on a practical scale in a three-storey building with a large attic floor above.

Turning to the question of insurance, the author remarked upon the refusal of the companies to allow any open arc lamp to work in a cotton-mill; and he combated their objections. He showed that there was complete absence of danger with the arc lamp used by him; and, in proof of this, he gave a description of it. He then passed on to notice the practical results of working by inverted arc lighting in his own establishment, which, he said, he had every reason to believe might be considered successful. When this mode of lighting was first started, and the gas turned off at the mains, there was much grumbling on the part of the workmen, who protested that it was absolutely impossible to perform their duties by the new light. However, they soon grew accustomed to it; and eventually expressed their preference for this system of illumination.

With regard to cost—a question which the author admitted was one of the greatest importance, and one rather difficult to deal with—he said he was hardly in a position to give sufficient data to be of much practical value. Taking into consideration the number of workpeople who could be served with the light, the cost was less than that of gas; and, of course, the light was stronger and more general. In the three-storey building at the author's works, there were 502 gas-jets, each burning 4 cubic feet per hour. Gas costing 2s. 8d. per 1000 feet would therefore come to something like 5s. 4d. per hour. In the 60 electric lamps, the only consumption was that of the carbons, reckoned at ½d. per lamp per hour—say, 2s. 6d. per hour. Taking everything into consideration, it was probable the cost of electric lighting would be more than that of gas; but as the light was so much more satisfactory, it might prove economical in most cases to adopt it. In the present instance, the total illuminating power of the 500 gas-jets would be roughly 8500 candles; while the arc and incandescent lamps combined would have 73,000-candle power, much of which was, however, useless, except for the general effect of the light.

THE ELECTRIC ARC STANDARD OF LIGHT.

Dr. Silvanus Thompson recently read a short memorandum before the Electrical Congress at Chicago upon what he calls the "Swinburne-Thompson unit of light;" this being his name for a standard of light based upon the radiation from the electric arc formed between pure carbon electrodes. It is stated that the adoption of such a unit of light was suggested in the spring of 1892 independently by Mr. James Swinburne and Dr. Thompson; and it is remarked that the advantages of such a source of standard illumination over all flame standards hitherto proposed are so obvious as scarcely to need mention. The carbon arc light proceeds chiefly from the crater which is formed at the end of the positive carbon; and if the carbon is pure, the light of the crater surface is uniform, with the exception of the edges, which are duller. The temperature of the crater surface is as definite as that of boiling water, and is taken by Dr. Thompson as being about 3500° C. If, then, by proper shielding, there is cut off all the stray light of uncertain colour emitted by the red-hot margin of the crater, so that only the true crater surface is visible, its whiteness will always be of the same unvarying quality. Increase of current, or of voltage, or of the length of the arc, has no effect upon this quality. It was in consequence of the recognition of these physical properties of the true crater surface that Dr. Thompson and Mr. Swinburne each made the proposition of using the arc as a basis for a new standard of light to replace the Violle standard, which never had more than a *succès d'estime*. Since this suggestion was first made, some work has been done towards its realization. Dr. Thompson has himself found that sources of error may be introduced by the thickness of the diaphragm and by an obliquity in its position. He has also made some experiments on the purity of carbons; and he finds that natural graphites always give less light than the artificially prepared hard carbons. The illuminating power of a square millimetre of hard carbon has been found by Trotter to be "something less than 70 candles." Dr. Thompson says that Professor Ayrton, adopting the periodic principle of photometry, lately described by himself, and using a photometric screen of the Lummer-Brodhun pattern, finds no difficulty in measuring light with a precision of one part in 500. "Doubtless," says Dr. Thompson, "the imperfections of the photometric methods until recent years were such that the production of an exact standard of white light was of less importance than is now the case, since photometry has become an art of precision." It is remarkable that a man who can claim this for modern photometry should have permitted himself to give such a vague definition of the illuminating power of his chosen light standard It will probably be found that, what with the variation of carbons and the difficulties in connection with the screening off of an exact millimetre of the crater surface, it will not be very much easier to make a perfectly reliable Swinburne-Thompson unit of light than a standard of another kind.

Velocity of Rays.—Mr. A. A. Boyden has lately transmitted to the Franklin Institute the sum of $1000, to be awarded as a premium to any resident in North America who shall determine, by experiment, whether all rays of light, and other physical rays, are or are not transmitted with the same velocity.

Presentations to Mr. J. D. Smith.—The Assistant-Manager of the Hawick Gas-Works (Mr. J. D. Smith) has been presented by the Directors of the Hawick Gaslight Company with a handsome marble clock, and by the officials and employees with a pair of bronze figures and diamond scarf-pin, on the occasion of his leaving to enter on his duties as Manager of the Selkirk Gas Company—an appointment already noticed in the Journal. The Secretary and Treasurer (Mr. G. Grier) made the presentations, which were siutably acknowledged by Mr. Smith. The clock bore a suitable inscription.

REGISTER OF PATENTS.

Gas Motor Engines.—Andrew, H. H., and Bellamy, A. R., of Stockport. No. 20,802; Nov. 17, 1892.

This invention relates, in the first place, to lubricating parts of engines with inverted cylinders. It is illustrated by figs. 1 and 2. The second part refers to means for preventing injury to the water-jackets of the cylinders, through frost. This is illustrated by fig. 3. The third part, illustrated by figs. 4 and 5, refers to means for actuating, without toothed gearing on the crank-shaft, the valve-spindles in engines having an explosion at every alternate revolution.

Fig. 1

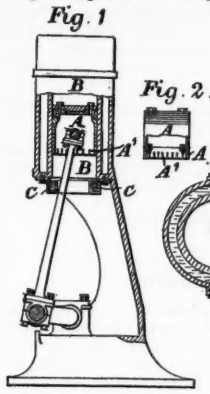


Fig. 2.

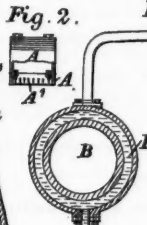


Fig 3.

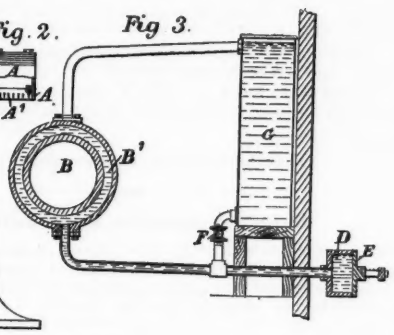


Fig. 5.

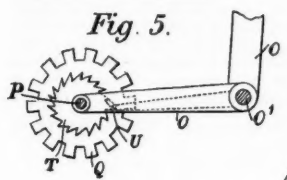
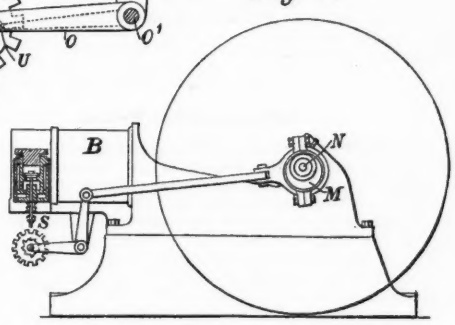


Fig. 4.



In order to lubricate the piston A and cylinder B of engines with an inverted cylinder, a number of holes A^1 are drilled round the piston a few inches or so from the bottom; and in order to make the metal expand, a saw-gate is cut from each hole through the metal to the bottom of the piston. A dish or tray C, placed below the cylinder, is supplied with oil, into which the cut end of the piston enters at the end of its down stroke; and it thus gathers some oil, which is carried into the cylinder, and lubricates it at every stroke. In place of drilling and cutting the piston as described, an attachment A^2 (see fig. 2) of a similar kind may be fitted to the piston, to carry oil and lubricate the cylinder.

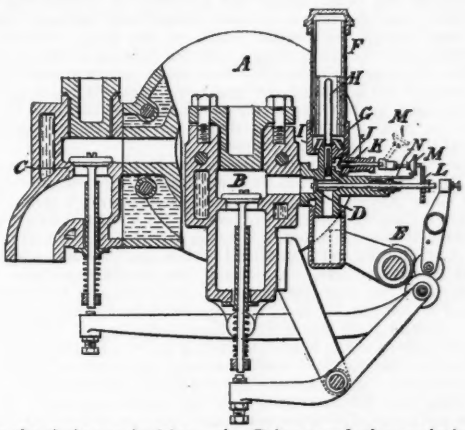
In order to prevent the cylinder of a gas or similar engine from being burst, through freezing of the water in the cylinder-jacket, it is proposed (see fig. 3) to place outside, or in a position most exposed to the weather, and in connection with the water-jacket B of the cylinder, a chamber or box D, fitted with a spring covering (E), which would yield, or with a thin and weak cover, which would break under sudden pressure. A tap F to cut off the supply of water from the reservoir G to the jacket would be kept closed at night, or when the engine was not working, to prevent any essential escape of water, in case the cover on the chamber should be broken by frost; and provision is made in the chamber or box to drain the water from the jacket of the engine-cylinder.

To dispense with the gearing and side-shaft for actuating the valve-spindles in engines of the "Otto" cycle, like figs. 4 and 5, an eccentric M on the crank-shaft N, which actuates an elbow-lever O, is pivoted at O^1 on the frame. The outer end of this elbow-lever is forked, and carries a stud P, on which is secured a notched wheel Q, arranged to lift the valve-spindle S at every alternate revolution of the engine in the following manner: On the stud in the lever-fork is secured a ratchet-wheel T; and this wheel has as many ratchet-teeth as there are notches in the notched wheel Q. Each time the elbow-lever is oscillated, the ratchet-wheel comes against a fixed pawl or catch U, which turns the wheel one tooth, and so raises the valve-spindle at one movement, and at the next allows the spindle to pass into one of the recesses of the notched wheel.

Gas Motor Engines.—Andrew, H. H., and Bellamy, A. R., of Stockport. No. 20,803; Nov. 17, 1892.

This invention relates particularly to means for firing gas-engines, either at starting or subsequently; and one object of it is to enable the ignition-tube to be removed and replaced by another tube, without displacing the valves or connections with the ignition-tube.

A is the power-cylinder of the engine; B, the explosive fluid-mixture admission-valve; C, the exhaust-valve; and D, the timing or ignition valve—all of which valves are operated by levers and cams from the side-shaft E, in the usual manner. Within the chimney F is the burner G, and the ignition-tube H, below which is a short tube I, in communication with a small chamber J, the exit from which into the atmosphere is controlled by a snifting-valve K. This valve is opened at or about the same time as the ignition-valve D, by means of a washer or projection L carried by the spindle of the ignition-valve. This comes in contact with a tumbler catch M, pivoted to the end of the spindle of the snifting-valve. The edge of the tumbler catch is bevelled; and a kicking-plate N is fixed to the frame, so that when the spindle of the valve K has been moved a certain distance, the catch is tilted by the plate N, and the valve K is left free to be closed.



When the timing or ignition valve D is opened, the explosive fluid mixture flows through the short tube I, ignition-tube H, and chamber J; and as the snifting-valve K is also opened at this time by means of the washer L and the tumbler catch M (as described), some of the gases escape through it into the atmosphere, until the explosive fluid mixture becomes ignited, and the consequent increase of pressure caused by the expansion of gases closes the snifting-valve. When the ignition-valve is again opened, the washer or projection on its spindle will open the snifting-valve, and allow some of the fluid mixture or products of combustion to escape through it into the atmosphere.

In certain cases it may be found advantageous to allow the snifting-valve to remain constantly operative, in combination with the ordinary timing or ignition valve D, as described. When this is not the case, the tumbler catch can be turned back, into the position indicated by the dotted lines, after the engine has been properly started, whereby the valve remains closed and inoperative.

Manufacture of Gas.—Van Syckel, S.W., of Newark, New Jersey, U.S.A. No. 15,174; Aug. 8, 1893.

This invention relates to apparatus for the manufacture of gas for illuminating and heating purposes—more particularly from oil and steam.

Fig. 1.

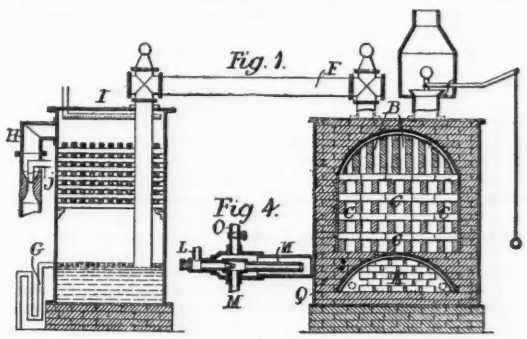


Fig 4.

Fig 2

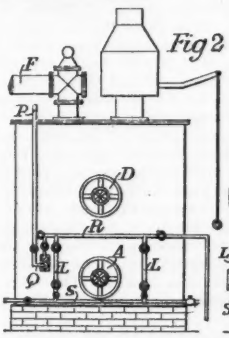


Fig. 3.

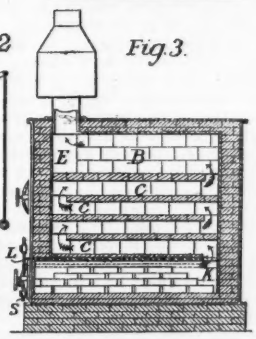


Fig. 1 is a cross-sectional view of the gas-generating furnace, together with its accessory scrubber and exhauster (some of the parts being shown in elevation); fig. 2 represents a front elevation of the furnace; and fig. 3, a longitudinal section and partial elevation of it. Fig. 4 represents, in longitudinal section, and on a larger scale, the construction of the preferred form of burner or injector used.

The generator is brick lined, mounted upon a suitable foundation, and provided with a gas-tight metallic casing. At the bottom of the generator is a basal chamber, formed by an arch, and accessible by means of a closing-plate A. Within this chamber is contained a body of refractory checker-work fire-brick, so as to present a large heating surface. At its extreme end, the chamber communicates with the

proximate ends of a set of horizontal multiple flues, located side by side, and discharging into a cross-flue, which in turn communicates with the ends of a similar set of horizontal multiple flues, connected in zig-zag order back and front across the generator. At the upper part of the furnace, there is a superheater, consisting of a series of flues connected with the cross-flue, and of varying heights. These flues B are surmounted by an arch; and the partitions between the flues present a largely increased extent of heating surface to that of any one of the sets of horizontal multiple flues C below them. They are located at the point where the products of combustion leave the generator; and, by reason of their considerable extent of heating surface, they absorb and retain much of the heat, while at the same time not materially interfering with the draught of the generator, as would be the case if the smaller flues below were continued in zig-zag order to the full height of the generator. The casing is provided with a removable plate D, upon whose removal the flues may be made accessible for repairs, by breaking down and removing a part of the masonry at the front of the generator.

The flues B discharge into a cross-flue E, from which projects a stack for discharging the products of combustion into the atmosphere; the stack being provided with a weighted valve, having a pivoted lever and operating-rod, whereby it may be closed gas-tight during the gas-making stage of the operation. A gas exit-pipe F also communicates with the cross-flue E, and is provided with a shut-off valve adapted to be closed by an operating-rod during the heating-up stage of the operation. The gas exit-pipe enters a scrubber, and dips below the water-level therein, as shown; the water-level being kept constant by a seal G. In the form of scrubber illustrated, the gas, on its way to the pipe H leading to the holder, is broken up by a grid-like structure, made up of wooden bars laid in alternate courses, opposite in direction and spaced apart. A perforated spray-pipe I distributes water upon the structure and the gases rising through it, so as to effect the condensation and removal of condensable and sooty particles from the gas. To establish and maintain a proper exhaust during the gas-making stage of the operation, a steam-jet J is used within the pipe H, and located in front of a contraction in it.

Within the basal chamber or combustion chamber K are inserted the discharge ends of two injector burners, preferably of the type illustrated in fig. 4. The construction of each injector will be readily understood. It consists of a steam-jet supplied from a steam-pipe L, having its discharge orifice located above an oil-supply pipe M, so as to draw oil up from the pipe, and project it into the oil and steam mixing pipe N. This pipe is surrounded by a concentric pipe supplied with air, preferably preheated by means of the pipe O. With a given steam pressure, this injector burner can be set to supply a flame of the desired calorific power. The steam is supplied through a pipe P, provided with a continuation Q, imbedded in the masonry of the generator above the arch of the basal chamber. Thus the steam, in passing through the pipe extension, will be heated to a high temperature, but without being brought into contact with the products of combustion, so as to be oxidized thereby. A branch-pipe R from the steam supply-pipe connects with the depending pipes L leading to the injector burner S; and a pipe S supplies liquid hydrocarbon to the oil inlet-pipe of the injector burner. Valves are provided for controlling, regulating, or entirely cutting off the flow of steam or oil through the several pipes, according to the necessities of the case.

The apparatus works as follows: The stack-valve being opened, a small fire is started in the combustion chamber K; and steam is then admitted through the inlet-pipe P, superheater Q, branch R, and depending pipe L, into the injector burners. The steam draws in oil from the oil-supply pipes of the injector burners, and, together with it, issues through the opening in front of the jet-nozzle, and finally into the combustion chamber—drawing in with it a quantity of air through the surrounding air-pipe. The mingled jet of steam, oil, and air becomes ignited; and this produces a flame of intense heat. The supply of air may, if desired, be further increased by opening the door of the combustion chamber more or less. The flame from the injector burners strikes the mass of checker-work fire-brick within the combustion chamber, and rapidly brings it to a high state of incandescence—generally approximating a cherry-red heat, and sometimes exceeding that degree, according to the particular character of the hydrocarbon employed. The products of combustion pass from the combustion chamber in a zig-zag direction, through the superposed sets of multiple flues C; and in their passage through them, they give up to the walls thereof a great quantity of heat. Finally, the products of combustion pass through the single set of superposed flues B, imparting to the more extended surface of the latter practically all of their remaining available heat; and then out through the stack into the atmosphere. When the apparatus is brought to the requisite degree of heat for decomposing steam and oil and re-combining their constituent elements into permanent fixed gases, the supply of steam, oil, and air is temporarily cut off from the combustion chamber, thereby extinguishing the fire therein. The door to the combustion chamber and the stack-valve are also closed; and thereupon steam and oil (but not air) are admitted through the injectors into the combustion chamber. The jets of steam and oil strike the highly-heated refractory material in the combustion chambers, and are decomposed thereby into gases, which pass through the flues C and B; and the exhauster is put in operation. The gas thereupon passes to the scrubber, and thence into the holder. The gas, on its passage through the flues, becomes fixed and combined into permanent gas of high candle power.

At the conclusion of the gas-making run, which generally lasts from about 20 to 25 minutes, under normal conditions, the apparatus is heated up as before, preliminary to a succeeding gas-making run. The apparatus is thus used alternately in preparing for the making of gas, and in the actual making and storing of the gas.

Sales of Stock and Shares.—Yesterday week, Messrs. W. Bush and Son, of Sheffield, disposed of £25,000 of 4 per cent. debenture stock in the *Sheffield United Gas Company*. Bidding was very brisk; and the prices obtained ranged from £124 to £131—the total realized being £31,268.——Yesterday week, 100 "B" shares in the *Camborne Water Company* were disposed of by auction at £15 each.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Dr. Bunte's Paper on Carburetting Illuminating Gas.

SIR,—The following English rendering of Tables B. and C. in Dr. Bunte's paper on the above subject, a translation of which appeared in the JOURNAL for the 17th inst., may perhaps interest some of your readers. It is only necessary to remark by way of preface that—

1. The English candle has been taken as equivalent to 1·14 Hefner units, in accordance with the recent official report issued by Professor von Helmholtz, of the Physical and Technical Institute, Charlottenburg. This makes the ratio of the Hefner unit to the English candle as 0·877 : 1. Mr. Dibdin found the ratios to be as 0·784 : 1.

2. The value of the mark has been calculated on a silver basis of 5s. per ounce, and has been taken as equal to 11·464 pence.

3. Several of the items in Table C. have been deleted, as they are expressed in terms rarely, if ever, used by English gas manufacturers.

Liverpool, Oct. 27, 1893. ALEX. M'I. CLELAND.

[The tables are given on the opposite page.]

Hislop's Regenerative Retort-Settings.

SIR,—I am not sure that Mr. Love's letter on the above in your last issue calls for any reply from me; but I crave the privilege of expressing my entire concurrence with his opinion that the retorts at Cockermouth *could* work off heavier charges of coal than they do. The time, however, has not yet come for us to carbonize more than 2½ cwt. per retort, whilst working two beds of sixes. Our heaviest daily make ranges between 80,000 and 90,000 cubic feet; and I need scarcely point out that six retorts are hardly sufficient to produce that quantity, while twelve may be considered a little too many. I look forward, however, to the time when we may be called upon to deliver more gas, and thus derive to the full the advantages of Mr. Hislop's excellent system of firing.

Cockermouth, Oct. 28, 1893. ER W. SMITH.

Prepayment Gas-Meters.

SIR,—I believe the plan adopted by gas companies using prepayment meters is to include in the charge for gas consumed the meter and fittings' hire. Will the engineers or secretaries of any of the companies using these meters kindly assist those who have the matter under consideration, by saying the increased charge per 1000 cubic feet which they find to be a fair and proper addition to the ordinary charge? Our gas is 3s. per 1000 feet net. What would be the fair charge per 1000 feet by prepayment meters?

Sheppy Gas Company, Oct. 27, 1893. A. W. MARKS, Secretary.

The Preparation of Hydrogen.

SIR,—In the issue of the JOURNAL for the 24th inst., mention is made (under "Notes") of a communication by Mr. John Ball, of the Royal College of Science, anent the preparation of hydrogen by means of zinc and dilute sulphuric acid, wherein the evolution of hydrogen is greatly facilitated by the addition of solutions of cobalt and nickel salts. It is further said that the action does not appear to have been noticed before.

I beg leave to state that, about eight years ago, I noticed a precisely similar reaction; but with copper sulphate solutions, instead of cobalt and nickel. The granulated zinc which was being used for the production of hydrogen, had been obtained by melting up old battery zincs, which had been previously amalgamated on the surface with mercury—as is ordinarily done in a Grove's battery. Now, whether this had anything to do with the subsequent inactivity of the zinc, I am not prepared to say (although in all probability it had); but the fact remains that the zinc refused to be acted upon by dilute sulphuric acid. Possibly an intimate amalgamation or alloy had taken place between the zinc and mercury during the process of melting, thereby preventing the ordinary action of the acid. In fact, afterwards, an examination of the granulated zinc yielded evidence of the presence of the latter metal.

Suspecting this, I concluded that the addition of a solution of copper would establish an electric couple with the zinc; and, accordingly, I added copper sulphate solution with the expected result—viz., an immediate and rapid decomposition of the acid, and copious evolution of hydrogen.

The zinc was granulated in the form of irregularly rounded, hollow pellets and cones, with extremely thin sides, in which there could have been but a very fine quantity of mercury, as there was not much (comparatively) to begin with.

I mention this because I have also observed that a solid lump of zinc, the surface of which had been freshly amalgamated with mercury, will neither yield to the ordinary action of the acid nor on the addition of the copper salt. This can be shown in another way; for if, during the liberation of hydrogen from acid by the combined action of zinc and copper sulphate, a globule of mercury be brought into contact with the dissolving metal, the action instantly and completely stops.

In the students' laboratory where the above took place, the method was used freely, so long as that special sample of zinc lasted, and indeed afterwards by myself with ordinary commercial zinc where rapid results were wanted—as at lecture-tables and the like. It was always found to be highly efficacious.

Avon Street Gas-Works Laboratory, Bristol, Oct. 27, 1893. ALEXANDER FYFFE.

TABLE B.—*Effect of Carburetting Gas of Bad Illuminating Power.*

Carburetting Materials.	Illuminating Power of 5 Cubic Feet.	Consumption of Carburetting Material for 100 Candles.		Fishtail Burner.	
		Argand Burner.	Slit Burner.	uminating Power of 5 Cubic Feet.	Consumption of Carburetting Material for 100 Candles.
	Candles.	Grains.	Grains.	Candles.	Grains.
I.—*Aromatic Hydrocarbons* ($C_n H_{2n-6}$)—					
Benzene ($C_6 H_6$), B.P. 176° F.	18·32	2389	2949	5·39	34384
	21·55	2504		7·54	17407
	26·94	2545		17·24	6768
Toluene ($C_7 H_8$), B.P. 231·8° F.	20·47	2280	3633	39·87	2268
II.—*Paraffin Hydrocarbons* ($C_n H_{2n+2}$)—					
Pentane ($C_5 H_{12}$), B.P. 95° to 104° F.	18·32	12741	11431	8·62	79023
	30·17	7252		16·16	30052
Hexane ($C_6 H_{14}$), B.P. 149° to 158° F.	30·17		8219		
	16·16	8122			
Petroleum ether, B.P. 167° to 176° F.	25·86	5640	9155		
	34·49	5922			
III.—*Unsaturated Hydrocarbons* ($C_n H_{2n}$) –					
Ethylene ($C_2 H_4$)	16·16	7489	13655	2·16	419650
	33·40	5939		15·09	25140
				25·86	11845
				7·54	27074
Amylene ($C_5 H_{10}$)	26·94	4873	6498	34·48	6346
				73·27	2588

TABLE C.—*Quantity and Cost of Light for Different Carburetting Agents.*

—	Cannel Coal.	Thuringian Gas Oil.	Crude Petroleum.	Petroleum Spirit (Gasoline).	Crude Benzol.
Gas from 1 ton, in cubic feet	12,559	19,736	24,042		
Illuminating power for a consumption of 5 cubic feet in candles	45·26	46·33	59·24		
Value in foot-candles	113,684	182,873	284,850		
1 ton costs . . . shillings	42/8	116/5	* 90/9 † 148/11	242/8	433/6
1000 cubic feet cost . . . do.	3/4·9	5/10·8	* 3/9·2 † 6/2·3		

* Duty free. † Including duty.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, Oct. 25.

(*Before Justices* WILLS *and* GRANTHAM.)

In re an Arbitration between the Yeadon Water-Works Company and Wright and Another.

This was an application on behalf of Mr. Wright to revoke a submission to arbitration under the following circumstances: The Water Company had entered into a contract with a Mr. Briggs for the construction of a reservoir. Included in the contract was one clause imposing penalties of £500 and £5 per diem for delay in the execution of the works after the date fixed; and another clause, in very wide terms, providing that any differences which might arise should be referred to the arbitration of the Engineer (Mr. Preston). During the progress of the works, Mr. Briggs became bankrupt; and the Company, under the contract, took possession of the plant and materials, and for a short time carried on the work. Then Mr. Wright, who had been financing the original contractor, and was his assignee, took over the contract, and completed the works, but not until about nine months after the time fixed. The Company then claimed the penalties under the contract, and called upon their Engineer to proceed to arbitration. Mr. Wright attended the first meeting to protest against the arbitration proceedings, and took out a summons to revoke the submission on various grounds. In the first place, there was a disputed claim for extra works, which he alleged were necessitated by the defective plans furnished by the Engineer, on which question, therefore, he could not be expected to decide impartially; in the second place, it was suggested that he had already prejudged the question of penalties by writing a letter calling attention to the fact that, owing to delays, penalties had already been incurred, whereas, under the peculiar circumstances of the contract having been taken over, there would be difficult questions of law as to whether or not any penalties could be legally claimed; and, lastly, there was said to be a claim by the contractor against the Company which was entirely outside the contract—viz., on the ground that certain trial holes made prior to the contract, in order that persons tendering might see the nature of the soil to be dealt with, were insufficient, and that the works were therefore much more expensive than had been anticipated. Mr. Wright was quite willing that the whole matter should be referred to any impartial engineer to be agreed upon or, in default of agreement, to one of the Official Referees.

Mr. C. E. JONES argued the case on behalf of Mr. Wright. Mr. TINDAL ATKINSON, Q.C., and Mr. CHITTY, for the Company, were not called upon.

Their Lordships held that no case had been made out for revoking the submission; and they dismissed the application with costs.

WOOLWICH POLICE COURT.—Friday, Oct. 20.

(*Before Mr.* R. H. B. MARSHAM.)

Conder v. The Gaslight and Coke Company.

In this case (to which we were only able to briefly refer last week) there were two summonses, which were taken out, under the Metropolitan Buildings Act, 1855, by the plaintiff, who is the District Surveyor of Woolwich—the first, for not giving notice as to the erection of a large building at the Beckton gas-works; and the second, for an irregularity connected with the building.

Mr. CONDER appeared on his own behalf; Mr. HORACE AVORY (instructed by Messrs. Bedford, Monier-Williams, and Robinson, of Great Tower Street, E.C.) represented the defendants.

It having been agreed to take the summonses together,

Mr. *Conder* stated that he had no witnesses to call; and, therefore, would give his evidence on oath. Proceeding, he said that, on Aug. 30, he discovered that the erection of a large building had been commenced by the defendants in his district; and he inquired why notice had not been given to him. The Company, however, questioned whether he had any jurisdiction in the matter. On Sept. 14, he served a notice regarding the irregularity in the building. His communications with the defendants were made through their Engineer; and he gathered they were under the impression that no notice was required in consequence of there being some exemption. The building was in the parish of Woolwich; and it was not exempted by any of the clauses of the Act of Parliament which gave exemption to certain buildings. Dock and railway companies' and other public buildings were exempted; but he never heard it claimed that gas companies' buildings were entitled thereto. On the contrary, there were several cases where their buildings had come under the jurisdiction of the district surveyor.

By Mr. MARSHAM: As to the size of the building, the limit allowed by the Act was 216,000 cubic feet; but the building in question (which it was intended to use as a retort-house) was seventeen times that dimension. The second summons was for irregularity—the Act requiring the building to be divided by party walls, and it was not.

In cross-examination, witness said he had been Surveyor in the district about eleven years. He could not say how long it was since the erection of the building was commenced; but it was probably a considerable time. He had never previously had a retort-house under his notice either as a district surveyor or an architect; nor could he say whether or not it would be impossible for the Company to carry on their business if the building were divided as suggested. This was the first occasion during the past eleven years that the Company had erected buildings within the parish of Woolwich; but his predecessor told him that, some 20 years ago, they constructed a retort-house, which, however, was smaller than the one now in dispute. He was not aware that the same question was tried in that Court in 1869; and that the Magistrate decided that the works were exempt from the operation of the Buildings Act.

This concluded the plaintiff's case.

Mr. AVORY submitted that, since the Company obtained their Act of 1868, their works and buildings had been exempt from the operation of the Buildings Act. It was a question of the greatest importance to them, because if this Act were held to apply to them, it would be absolutely impossible for them to carry on their business. In 1869, the then District Surveyor, in order to test this question, took out a summons alleging a breach of the Act by the erection of one of the retort-houses. The matter was fully argued before Mr. Paterson, who dismissed the summons on the ground that the works were exempt, and no case was stated. Then, some years ago, another effort was made to try the question by summoning the South Metropolitan Gas Company; but the Magistrate in that instance—perhaps feeling that it was a difficult matter—adjourned the summons *sine die*, and nothing more had been heard of it. The District Surveyor in that case accepted the position, and never attempted to raise the question again. Turning

to the ground on which he maintained that the Company were exempt from the Act, he said that they were a railway company; and the works of railway companies were exempt.

Mr. MARSHAM: But the railway is a very subsidiary part, I should think.

Mr. AVORY admitted this; but said he could show that it had been decided that, although a railway was only a subsidiary part of such works, and auxiliary to the main purpose of the Company, still they were entitled to all the benefits of the Railway Clauses Act, and any other privilege that a railway company had. Supposing a dock company obtained power to construct a railway, and became a railway company in that sense, then they were entitled to all exemption from seizures. If he was driven to it, he should ask for a decision in his favour on that ground, because, by section 6, the works of a railway company were exempt, and, by their Act of 1871, the Company were authorized to construct a railway, which was, in fact, worked by the Great Eastern Railway Company. Counsel then called attention to certain of the provisions of the Company's Act of 1868. Section 40, he said, gave them the power to make and store gas and convert and dispose of coke, tar, &c., "provided always that the arrangements adopted . . . shall embrace the most improved method in use at similar works from time to time established." There were many gas-works throughout the country with buildings of equal, and even larger, size to the one in question; and if there were partitions in these houses, as prescribed by the Buildings Act, it would be absolutely impossible to carry on the work. Then section 43 gave them power to erect all such buildings "as they deem requisite" for the purpose of their business. Then, again, by their 1876 Act, they were empowered to purchase further lands, and erect thereon such works "as they may require or deem necessary or expedient for efficiently and economically carrying on their undertaking." Under the express powers of these Acts, he submitted that the Company were exempt from the operation of the Buildings Act; and he would call a witness to prove that they would not be able to carry on their business either "efficiently" or "economically," if the building were divided as suggested.

Mr. *G. C. Trewby*, the Chief Engineer of the Company, was called, and gave evidence to the effect that the erection of the retort-house to which the summonses referred was commenced in September, 1890; and, until the notice from Mr. Conder, he had heard no complaint in regard to it. He knew as a fact that there was a summons to test this question in 1869; and that it was dismissed by the Magistrate on the ground that the buildings were exempt. The size of the building was about 4 million cubic feet; and it would be utterly impossible for the Company to carry on the business economically if it were divided. They had a retort-house at Kensal Green of upwards of a million cubic feet capacity; and nobody ever suggested it would be subject to the Buildings Act. The retort-houses at Birmingham, Newcastle, and Leicester were all of a capacity exceeding a million cubic feet.

Cross-examined: Since 1869, when the last summons was taken out, they had erected certain other buildings at Beckton; but they did not give notice to the District Surveyor, nor did they in the case of the Kensal Green house. The Surveyor of that district must have been aware of the erection of the building; he could not help seeing it.

Mr. CONDER then submitted that, whatever was done with regard to the second summons, there was no evidence to show that the penalty on the first summons should not be imposed.

Mr. MARSHAM: If they are exempt under their Act, they are not bound to give you notice.

Mr. CONDER: They have power to erect certain buildings for the purposes of their business; but, as the Buildings Act is not referred to in their Private Acts, they are not exempt from giving notice.

Mr. MARSHAM: Can you suggest how they could carry on their business, if they had to divide the buildings into small parts?

Mr. CONDER: It is not for me to make those suggestions. If the Company cannot carry on their business without a building of this capacity, it is within your power to exempt them. You can adjourn the summons, as in the South Metropolitan case, and take no further action.

Mr. AVORY said he wished to remark that Mr. Conder had said they were liable for not giving notice; but he (Mr. Avory) contended that, if they gave notice, they admitted the jurisdiction of the District Surveyor, because, on receipt of the notice, he would have to inspect the works, and cause all the provisions of the Act to be observed.

Mr. MARSHAM, in giving his decision, said his view was that the Company were exempt. Under their various Special Acts, they were allowed to do what was necessary for carrying on their business; and the house in question was a necessary work. He was not deciding the question on the Buildings Act as to whether they were a railway company; but, under their Special Acts, in his opinion, they were exempt from the operation of the General Act. With regard to the notice, as the District Surveyor could not enforce the rules of the Buildings Act, he could not insist on the Company giving notice. This being so, he must dismiss the summonses, without costs. In reply to Mr. Conder, his Worship intimated that notice of appeal could be given within seven days.

Cookery and Food Exhibition.—The seventh exhibition of cookery and food, organized by the Association which has for its object the promotion of the sciences of cookery and domestic economy, was opened at the Portman Rooms, Baker Street, last Tuesday, by the Baroness Burdett-Coutts, who was accompanied by Mr. Burdett-Coutts, M.P., President of the Association, and a number of ladies and gentlemen interested in its work. There were about 300 exhibits, grouped under 16 divisions. Among the exhibitors of culinary appliances were Messrs. R. and A. Main, of Glasgow and London, and Messrs. W. Sugg and Co., Limited. Gas-stoves provided by these makers were employed in the cookery competitions, which were a prominent feature of the exhibition. Lectures and demonstrations were given daily during the week; one being by Mr. A. P. Main, on "Cookery, Ancient and Modern," which was illustrated by lantern views. The exhibition closed on Saturday with a lecture by Miss J. Mears, of the National Training School of Cookery, on "Food for Thought in Cooking and Eating."

MISCELLANEOUS NEWS.

THE CRISIS IN THE COAL TRADE.

We continue to-day our record of the progress of events in the great dispute in the coal trade, which is having such serious effects on the industry of the country.

The past week opened with a second conference of Mayors at Sheffield. There were present the Mayors of Sheffield, Leeds, Nottingham, Derby, and Barnsley. The Mayor of Bradford was unable to attend. The meeting lasted for about an hour and a quarter, when the following record of the proceedings was communicated to the representatives of the Press: "At a meeting of the Mayors of Leeds, Derby, Sheffield, Nottingham, and Barnsley (the Mayor of Bradford being unable to attend), the present situation of the coal crisis was reviewed and discussed. Disappointment was generally felt that no result had been arrived at on the basis of the suggestions made at the Sheffield conference on the 9th inst. It was decided that it would be unwise to make any further suggestions at present, but that an intimation should be conveyed to the representatives of the federated coalowners and the representatives of the Miners' Federation that the Mayors would be glad to arrange for a meeting between themselves and the contending parties, if desired by either side." A copy of this minute was forwarded by the Town Clerk to the Chairman and Secretary of the Federation. The Mayors did not receive until Monday the letter of Mr. Ellis, the Secretary of the Coalowners' Federation, suggesting that he should name six chartered accountants, of whom Mr. Pickard should select one, to make an examination of colliery books, so as to decide the question of miners' wages before the dispute. The Mayor replied to Mr. Ellis to the effect that, as Mr. Pickard's answer had been given, it would serve no good purpose for him (the Mayor) to move in the matter. If both parties had been willing to accept the suggestion, he would have been pleased to accede to the request. Mr. Pickard's answer (as published in the *Sheffield Independent*) was as follows:—

It is said anything can be done with figures. I have no doubt in my mind with regard to such a statement. It appears coalowners and managers just now are displaying wonderful talent in this connection. Now, I have a desire that the general public should know exactly what the average wages of all persons underground are. First, prior to the advances obtained and after. Secondly, I have a desire that the public should know what profits coalowners have, what are the wages of colliery managers, and what are the fees those gentlemen called Directors have over and above the ordinary profits of the firm, and how those wages and fees swell the cost of production.

I am told that in to-day's papers Mr. Ellis throws out a challenge on one of those questions—namely, that of the miners' average wage. He suggests three pits should be selected in each county within the Federation, and that these three pits' books shall be open to chartered accountants, and that they shall examine the books, I suppose, as kept by the managers, without calling in the men to check or correct them; and such chartered accountants shall publish what they find in such unchecked books. My suggestion is that the names of all persons receiving pay from profits on the raising and selling of coal shall be named at every colliery within the Federation area, every class of workmen stated, every boy under 16 years of age, every young man under 21 years of age, coal hewers, trammers, datalers, and off-hand men, also deputies, fire-triers, and managers for the years 1885, 1886, and 1887 inclusive; also the entire cost of production and the cost of placing a ton of coal into the coal-waggon. Further, what was the share capital of the colliery on these dates, and what were the profits realized during the years ending 1885, 1886, and 1887.

I also suggest to the Press that the coalowners offer to allow them to examine the books to find out the average wages, cost of producing a ton of coal, and into the wage and profits to the colliery owners thereon during the years 1891, 1892, and 1893. If the public have a right (and I am not about to contest that right) to know what the miners' average wages are, they have also a right to know what profits—gross profits—are made by the colliery owners, what salaries they receive, what they pay their managers, and what amount of Directors' fees are paid, in order to find out what goes to the workman, what to the management, what to the shareholders, and what to the reserve fund. In fact, the country ought to know what it costs to get a ton of coal, what it sells for in the market, what workmen all round receive for the work done, and what the capitalist receives on his investment. I challenge the coalowners to give this information. I wait with calm mind public opinion, and the influence the disclosure will have on the public judgment on the coalowners' demand for a reduction of 25 per cent. off the workmen's wages. The public Press ought to insist that colliery owners grant the suggested inquiry. Everybody will note that to make a statement of what the men earn in one particular department, and not to give the earnings or profits of the coalowners, would be most unfair and misleading. If the coalowners allow my suggested examination of their books, I assure the general public they will find such a revelation, they will have such a surprise, as will tickle their fancy for many a long day. Will the coalowners accept my challenge? Will they pledge themselves to make a full inquiry? Now, Mr. Ellis, here is a fine opportunity to convince a generous public that the owners can or cannot afford to pay 40 per cent. advance on the wages of their workmen on the 1888 rates.

Nearly the whole of the Warwickshire collieries had resumed work on Monday; and out of about 6000 men only 300 were idle. No material change had taken place in the St. Helen's district. The Frodsham pit, belonging to the Liverpool and St. Helen's Brick Company, was opened at St. Helen's, at a 15 per cent. advance in wages; and the masters agreed to deduct the Federation levy of 1s. per day. About 150 men find work there. This colliery has all through the strike paid the old wages; but, with the increased prices of coal, the men demanded the advance now conceded. The colliers in the Wigan district expressed great disappointment at finding the report that the Scot Lane Collieries, Blackrod, would be opened at the old rate of wages was not true. On the receipt of the telegram from Mr. W. Woods, part owner of the collieries, there was doubt whether the other partner in the firm—Mr. Marshall—would agree to the terms indicated. It now turns out that the doubt was well founded. Rumours were rife during the latter part of last week that several collieries in the Wigan district would commence operations on Monday; but there was no appearance of the masters giving way. The Derbyshire coalowners met at Chesterfield to discuss the situation. It was not considered necessary to pass any resolution on the wages question, as no change of feeling was expressed—every owner stating readiness to commence working when the

colliers accept 15 per cent. reduction. It was thought the struggle was drawing to a close, as the relief funds were collapsing. At Chesterfield, the Charity Organization Society resolved to discontinue all relief except children's breakfasts; and similar decisions, owing to lack of funds, have been come to in most parts of the country. On the London Coal Exchange, the advent of colder weather increased the inquiry for house coal. The demand for gas coal continued to advance; and, the supply available being small, as much as 17s. *ex* collier in the Thames was asked.

On Tuesday, Lord Vernon decided to re-open his Poynton Collieries, employing about 700 men, at the old rate. His Lordship's agent published a letter, in which he explained that Lord Vernon would feel it very inconsistent on his part to withdraw his support from the Coal-owners' Federation now, unless he was compelled to do so; and it was only because he found himself placed in an almost untenable position, by the action of his neighbours, that he was bound to take independent action in the interests of his collieries and of his workmen. The letter proceeded: "The North Staffordshire collieries are at full work on one side, and during the last fortnight nearly all the collieries in the Ashton and Oldham districts have commenced work on the other side, and some are actually working double shifts. In pure self-defence, therefore, Lord Vernon, finding his markets being undermined, and his customers being gradually taken from him, is obliged to re-open his pits at the old rate of wages, pending the general settlement; but, at the same time, he wishes to have it understood that it is only circumstances which have forced him to adopt this course of action, and that he has no wish to sever his connection with the Coalowners' Federation." The correspondent who reported recently in *The Times* on the favourable position occupied by Accrington during the coal crisis, through having all its pits working, has since stated that he has made investigation into the rumours which were current in the district as to the stocks of coal on hand in the neighbouring township of Oswaldtwistle; and he now finds the statement that there were several hundred thousand tons to have been a great exaggeration. Mr. D. A. Thomas, M.P., speaking at a crowded meeting of colliers, held on Tuesday night at the Oddfellows' Hall, Dowlais, said there was no doubt that, although they were not, as a rule, in competition with the Midlands, the demand for Welsh coal was very much stimulated at the present time by the cessation of supplies in England, and that a good deal of South Wales coal was finding its way inland. They all wished, however, for a speedy termination of the English strike; for, however much it might influence the prices in Wales, they were not desirous of making money at the expense of the sufferings of others. He could not help thinking that it was a matter for regret that men and employers should both have rejected the basis of a compromise put forward by the Midland Mayors. Although he did not pretend to understand the merits of the dispute, he appreciated the grounds of the workmen for refusing arbitration. He thought the public were justified in asking for fuller information about the wages earned by the men before the strike began. The most conflicting and widely-divergent statements had been made by the two sides in the dispute; and the public were entitled to know where the truth lay.

Wednesday was not very eventful. Pending a general settlement, Lord Vernon's miners, to the number of 700, resumed work at Poynton, at the old rate of wages. Numerous orders had been received at the colliery from mills in the district, many of which had been working short time; while others had stopped, in consequence of the scarcity of coal. The price of coal in Stockport and the neighbourhood was reduced 5s. per ton. A delegate meeting of the Lancashire and Cheshire Miners' Federation was held at Manchester—Mr. Aspinwall presiding. Reports were presented from the various districts, showing that the number of miners in Lancashire who had commenced work, or had permission to commence at the old rate of wages, was about 6000. Those at work had all paid their levies. Mr. T. R. Ellis, Secretary to the Coalowners' Federation, stated, with reference to the resolutions passed at the recent coalowners' meeting at Manchester, that there appeared to be a misconception upon two points—first, that the miners were to be pledged to a reduction before the suggested meeting, in the last paragraph of the resolution. This was not the intention. Secondly, the further intention was, as suggested in the third paragraph, that the proposed Joint Committee, when formed, should have power to decide as to whether the 15 per cent. reduction upon which the miners returned to work pending a settlement was too much or too little; and if the decision should be that the reduction was too much, the excess should be refunded to the men as from the time they returned to work. Mr. Black, Secretary of the Nunnery Colliery Company, Sheffield, stated that his Company were prepared to guarantee a wage of 6s. per day for three months, on the understanding that the men produce the same average output per man as was produced before the strike commenced. A somewhat similar proposal emanated from the Staveley Coal and Iron Company, Limited, who offered to re-open their Markham No. 1 pit on the following terms: "Skilled labour (*i. e.*, stallmen), 7s. per day's work; loaders, 5s. per day's work. No stoppages from the above rates, except house rent and club. A load of coal to be allowed each householder once a month. The Company to find tools on the following definite understanding: That the coal-getters working in the face treat the above Company fair and square, and that the output per man per day be not less during the next twelve months than the last twelve months prior to the stoppage." On the London Coal Exchange, a very strong tone again ruled. The inquiry from merchants when the market opened was brisk. But those having coal to sell adopted a very independent attitude; and for all descriptions of house coal, a further advance was demanded. Seaborne house coal was raised another 1s. 6d.; for inland house coal even a greater advance was wanted—some representatives of the North Staffordshire collieries refusing to sell under 25s. to 30s. per ton. There was really no gas coal offering upon the market—the whole of the supplies coming forward being required to fill contracts; and Durham rough small easily made 13s. per ton delivered into barge.

On Thursday there was a break in the clouds; and, for the first time in this protracted struggle, a fair prospect opened up of the contending parties meeting to discuss their differences. The officials of the Miners' Federation did not seem to have quite understood the statement made by Mr. T. Ratcliffe Ellis, the Secretary of the Coal-owners' Federation, as to the resolutions adopted at the Manchester conference. A letter subsequently received from him by Mr. Ashton, the Secretary of the Miners' Federation, was regarded as removing any difficulty that stood in the way of the parties coming together Mr. Ellis, in his letter, said: "I regret that you consider the Manchester resolutions add to the deadlock. They were adopted with the view of removing it. With regard to the suggestion contained in the last paragraph of your letter, I am instructed to inform you that the Committee of Coalowners are prepared to meet the representatives of the Miners' Federation to discuss the whole question, without prejudice to the position of either party, at an early date." A meeting of the Sub-Committee of the Miners' Federation was held on Thursday afternoon, in Manchester, to consider financial matters. All the members were present; and Mr. B. Pickard, M.P., was in the chair. Mr. Ellis's letter was laid before the meeting, and was regarded as a proposal for a joint conference on much the same terms as were put forward in the resolution passed at the last general conference of the Miners' Federation; but as the Sub-Committee had no power to come to any decision on the subject, it was resolved to bring the question before a full meeting of the Executive Board, to be called without delay. There seemed to be little doubt that the conference would then be arranged; and strong hopes were expressed outside that a settlement of the dispute would be come to when the two parties had met unfettered by any preliminary conditions. It was reported that, for the first time during the past fifty years, not a single ton of coal was shipped for export from the ports of Hull, Grimsby, or Goole in the week ending the 21st inst. In the same week of 1892, these ports shipped 48,779 tons; and in that of 1891, the total was 49,028 tons. The agent of the Lothian Miners' Federation received a letter, written on behalf of the Coalmasters' Association in Mid and East Lothian, intimating that, if the miners of the Lothians persist in their four-day policy, the masters will be forced to adopt stringent measures for their own protection. A correspondent of *The Times* wrote as follows: "Mr. Lockett, the champion of the coal merchants in London, recently stated in the public Press that the depression in the coal trade which produced the present crisis was due to the advance in the rate charged for conveying coal to London. He had to admit that there had been no advance in the rate itself; and the utmost he could make of the increase was the alteration brought about by charging 20 cwt. to the ton, with an allowance of 2 cwt. per truck for wastage now, instead of 21 cwt. as formerly. Even according to Mr. Lockett, this was only an advance of 3d. or 4d. on a value of 17s. per ton. The London merchants have studiously avoided mentioning the fact that the coal rates in many districts have been considerably reduced; the diminution of tolls on the Midland Railway system alone from this cause amounting to £40,000 per annum. It is well known that the difficulty under which Midland colliery proprietors have suffered was brought about by the Durham strike, which led to their generally increasing their output to meet the deficiency in supplies from Durham. As soon as the Durham pits resumed work, they found their markets fully supplied from the Midlands; and the only way in which they could rehabilitate themselves was to pour cargo after cargo of coal into the Thames, and sell it for what it would fetch, which they did. The Midland colliery owners, thus having a largely increased output to dispose of in a restricted market, applied to the railway companies to lower the rate; but their own figures, as laid before the railway managers, showed that it was by shillings and not by pence that the rate must be reduced to be of any use to them, as any reduction in the price of Midland coal would be followed up by a further reduction in Durham prices—the Durham owners being compelled to recover their position in the market. The railway companies declined to assist in a competition of so ruinous a character."

A large and influential deputation waited upon Mr. H. Fowler, M.P., the President of the Local Government Board, at Wolverhampton, on Friday, in reference to the coal trade dispute. It consisted of clergymen, Nonconformist ministers, Roman Catholic priests, and other residents from Cannock Chase, together with representative manufacturers and inhabitants of Wolverhampton, who desired to bring to his notice the terrible state of things prevailing in the Cannock Chase district, owing to the prolonged stoppage of the pits. They wished him to urge upon the Government the desirability of facilitating, either through the Board of Trade or legislation, the appointment of an independent court of arbitration to settle similar disputes. After hearing the views expressed, Mr. Fowler promised to convey them to his colleagues in the Cabinet. Mr. J. Haslam, the principal agent of the Derbyshire miners, addressing a great meeting of miners at Blackwell, described the invitation of the coalowners to meet the men as a harbinger of peace. He said it must be accepted, for, in the interests of everybody, it was time that the parties to the dispute came together, shook hands, and showed that capital and labour were in reality twin sisters. Let the men go in at the old rates, and agree to meet their employers in the future to discuss every exigency for their mutual benefit. Mr. A. M. Chambers, the President of the Coalowners' Federation, stated at Sheffield that the letter sent by their Secretary did not embody any new departure on the part of that body, but was a continuation of the policy they had pursued from the beginning of the dispute. The employers, he said, had been willing all along to meet the representatives of the men. The reply of the Miners' Federation to the resolutions passed by the coalowners at the Manchester meeting, which had not been published, was addressed to Mr. Ellis, and was as follows: "Dear Sir,—Your letter of the 19th inst., with resolutions passed at the coalowners' meeting at Manchester enclosed, received. I am sorry these resolutions have added to the deadlock. I am debarred from calling any further meeting of our Federation so long as the proposed reduction of 15 per cent. remains in the way. The Federation representatives are prepared to meet the coalowners at any time to discuss the open question.—(Signed) THOMAS ASHTON." It came to the knowledge of the officials of the Coalowners' Federation that there was some misconception as to the meaning of the Manchester resolutions. Mr. Chambers stated that the offer to meet the representatives of the Miners' Federation, referred to in one of these resolutions, did not mean that the owners intended them to go to work at the reduction of 15 per cent. before that meeting took place. The real intention

was that a joint meeting should be held, in order to discuss the whole situation. The letter written by Mr. Ellis to Mr. Ashton fully explained this, and was not in any way an alteration of the attitude taken by the Coalowners' Federation. By attending such a conference, the Miners' Federation were not expected to be looked upon as in any way pledging themselves to the principle of reduction. Practically the phrase, "the open question," used by Mr. Ashton in his letter, and the phrase, "the whole question without prejudice to the position of either party," used by Mr. Ellis in his letter, are regarded by the coalowners as being identical. Mr. Chambers and two other leading coalowners were in London on Wednesday on other business. No meeting, either of the Federation or executive, was appointed for that day, or held; but as Mr. Ashton's letter was before them, it was considered desirable that it should be answered without delay, particularly as a misunderstanding appeared to exist with regard to the resolutions to which it referred. Mr. Ellis was therefore instructed to write to Mr. Ashton, and to intimate that the Manchester resolutions were not intended to add to the deadlock, but were adopted with a view to remove it. Having regard to the misconception as to the Manchester resolutions, and to the fact that a joint meeting was now almost certain to be held, Mr. Chambers considered the prospect of a settlement to be hopeful. A very strong tone prevailed on the London Stock Exchange on Friday, owing to the moderate supplies of house coal offering and the increased requirements of the trade, as the result of the colder weather. Seaborne house coal was advanced another 2s. per ton to merchants, who decided to raise prices to the public and dealers by 4s. per ton. Best Wallsends were therefore 38s.; and house coal, 36s. Coke was unaltered at 15s. per twelve sacks.

At the Miners' Federation offices at Barnsley on Saturday, Mr. B. Pickard, M.P., said the statement of Mr. A. M. Chambers in that day's papers was a flat contradiction of the letter sent by Mr. Ellis to Mr. Ashton. Mr. Ellis, as he understood, authorized by a meeting in London, wrote that the coalowners were willing to meet representatives of the men to discuss the general question without prejudice. The resolutions of the coalowners' meeting in Manchester, if they meant anything at all, meant that the owners could not meet the representatives of the men unless they were prepared to debate the question of a reduction of 15 per cent. At the same time that Mr. Ellis sent his letter to Mr. Ashton, he enclosed another statement which practically bore the construction Mr. Chambers now gave. The main point was whether Mr. Chambers or Mr. Ellis was speaking the mind of the Coalowners' Federation, because each contradicted the other. Which of the two versions was the Executive to consider? His advice to the colliery owners who were desirous of resuming work was to make terms at once with their men. This see-saw business might suit certain parties, or it might not; but it was quite clear that the time had come when there should not be two voices in either camp. Let it be "Yes" or "No," so that if there was to be a meeting the men would know whether or not they were meeting a double or single edged sword. The price of coal was creeping up in London; but it was not the miners who were to blame, for they were ready and willing to go back to work at the old rates. He, however, had nothing to do with the price of coal. All he said about it was that it should be sold at such a price as would pay a fair wage to the miner, and give a fair profit to the colliery owner. He hoped, notwithstanding the apparent misunderstanding between Mr. Ellis and Mr. Chambers, that a settlement would be arrived at—a mutual settlement, one that would be lasting, and be fair to both workmen and owners.

In another column will be found a few particulars as to the effect of the dispute on gas-works in Lancashire. With regard to the Midlands, at a meeting of the Birmingham Gas Committee on Monday, the Secretary (Mr. E. Smith) reported that the stock of coal at the works had diminished to 33,000 tons. Deliveries were being continued on all contracts, with one exception. The supplies came from districts in which the men had resumed work. The purchase of coal had been made at increased prices, which, sooner or later, would lead to an advance in the price of gas. The Committee, with the supply they now had, hoped to be able to go on until the end of the year. At Coventry, the Gas Committee have found it necessary to buy coal in the open market, so as to keep up a supply of gas. At Leicester, the Gas Committee have purchased a fortnight's supply of coal, at a loss of £4500; and an intimation has been given that the price of both gas and coke may have to be advanced. The Chairman of the Committee (Mr. Alderman Lennard) stated, at a special meeting of the Town Council on Monday last week, that not an ounce of coal had been received under their contracts with the colliery proprietors since the dispute commenced, as they claimed immunity during strikes or accidents. As the stocks had run out, and the Committee had sustained loss, they had determined to call on the owners, and ascertain whether they claimed equal immunity in the event of a lock-out, seeing that they had had no demand for an advance of wages, and would have made no concession to the Corporation if they had effected a reduction. If, however, the owners still repudiated their liability, the Committee intended to take Counsel's opinion upon the "strike" clause.

In connection with the agitation which has arisen in many places as to the price at which coke is sold to large and small consumers respectively, the discussion which occurred at the meeting of the Burnley Town Council last Wednesday is not without interest. The Gas Committee presented a report from which it appeared that, in accordance with an arrangement made some years ago, it had been customary to supply the Leeds and Liverpool Canal Company, as well as several large ironfounders and others, with coke at 5s. 6d. per cwt. The Committee had, however, decided to break this arrangement, and charge these customers the current price for coke. Alderman Collinge, the Chairman of the Gas Committee, explained that the contracts were entered into many years ago, when there was very great difficulty in disposing of the coke. This statement was confirmed by Mr. Alderman Greenwood, who, however, said he doubted whether written documents confirming the arrangement could be produced. Several members of the Corporation expressed surprise at the fact that the Committee had allowed a few individuals to be favoured in the matter of the supply of coke; and they strongly urged them to insist upon the strike clause in any new agreement they might make.

THE LONDON "GAS CONSUMERS' PROTECTION LEAGUE" AND THE PRICE OF GAS NORTH OF THE THAMES.

Last Thursday evening a Conference of Delegates from London Vestries and District Boards was held at the St. Luke's Vestry Hall, City Road, "to consider the present price of gas and anomalies in existing charges, &c." Mr. E. Howes, of the St. Luke's Vestry who were the conveners of the conference, presided; and delegates were present representing the Local Authorities of Bethnal Green, Chelsea, Clerkenwell, Hammersmith, Paddington, Westminster, Marylebone, Shoreditch, Holborn, Whitechapel, St. George-the-Martyr, Southwark, Islington, and St. Luke's.

The Chairman said it might be considered that the conference was convened at an inopportune time, having regard to the existing coal dispute. But the date was fixed in July last; and the question before them was not one of passing moment. The price charged by The Gaslight and Coke Company to their customers north of the Thames, where they practically had a monopoly, had long been a burden to the consumers; and the question ought to be definitely settled without further delay. Notwithstanding the unfortunate coal dispute, the Commercial Gas Company, which mainly supplied East London, gave notice of their intention to reduce the price of gas at Christmas from 2s. 9d. to 2s. 7d. per 1000 cubic feet. The present charge, however, of The Gaslight and Coke Company north of the Thames was 3s. 1d. per 1000 cubic feet, as against 2s. 5d. on the south side of the water, where the Company had a competitor in the South Metropolitan Gas Company. This difference in price of 8d. per 1000 feet was a serious matter alike to the small and the large consumers; and there was no just reason why the difference should exist. Another grievance was that, whereas in the City of London—thanks to the vigilance of the Corporation there—meters were furnished free by The Gaslight and Coke Company, elsewhere a rent-charge was made for their use. The time had arrived when, in the public interest, the statutory powers granted to London Gas Companies should be revised and amended. Finally, the Chairman pointed out how much better off the provinces were in many parts than London in regard to gas supplies, seeing that they not only had better and cheaper gas, but at a price which admitted of a profit that went to the reduction of the local rates.

Mr. James Rowlands, M.P., the President of the Gas Consumers' Protection League, sought to show that even when the price of coal was diminishing, The Gaslight and Coke Company raised their charges; and if they urged, as they did, the enhanced cost of labour and the reduction of working hours as reasons for the rise in the price of their commodity, it was strange that the South Metropolitan Company, who had precisely similar conditions to contend against, were able to supply gas at 2s. 6d. per 1000 cubic feet.

Mr. Rumball (St. Luke's) moved—"That, in the opinion of this conference of delegates from Vestries and District Boards of parishes and districts situate within the area of supply of The Gaslight and Coke Company, the time has arrived when the existing anomalies in the charges for gas supplied and use of meters by the several Companies supplying gas in the Metropolis should be removed; and that all gas supplied in the Metropolis to private consumers should be at an uniform charge per 1000 feet, with the free use of meters."

This motion was seconded by Mr. R. H. Griffith (Clerkenwell), and carried, after discussion, unanimously.

The following further resolution was similarly adopted: "This conference is also of opinion that it is desirable that a parliamentary inquiry should be instituted into the present management and working of the various Gas Companies, their existing statutory rights, and the past results, financial and general, of the statutory sliding-scale of price and dividend; and that the existing limit of statutory dividend should now be modified in the direction of the reduction in the amount thereof." It was also sought to refer to the proposed body of inquiry the consideration of the desirableness or otherwise of the acquisition of the several gas undertakings in the public interest, and their control by a central Metropolitan authority. This it was thought might, if adopted, be construed as an indication of a desire to buy the undertakings; and hence, on that ground, the motion was rejected by 13 votes to 7.

Finally it was decided to seek an interview with the President of the Board of Trade on the subject of the adopted resolutions; to send copies of them to the Vestries and District Boards; and to invite their support of the decisions arrived at by the conference.

STREET LIGHTING AT PRESTON.

Gas versus Electricity.

Last week a debate arose in the Preston Town Council on the respective merits of gas and electricity as a means of street lighting. The Streets and Buildings Committee have already lighted Fishergate, one of the principal thoroughfares by electricity; and the question which the Council had to decide was whether this form of illumination should be also employed in the neighbouring Church Street. Alderman Satterthwaite, Chairman of the Streets and Building Committee, said that, when the lighting of Fishergate by electricity was undertaken, it was in the nature of an experiment; and with the understanding that, if successful, it should be extended at some future time. The Committee had given the matter very careful consideration; and they did not see their way to recommend the extension of the lighting to Church Street. They found that to light Church Street as Fishergate was lit at the present time would entail an additional expenditure over the present annual cost of £112; and the Committee did not consider the light was worth this. They believed that, for an additional expenditure of £30 or £40 a year in gas, they would get a light more generally diffused, and that it would serve the town better than an extra expenditure of £112 per annum in electric lighting. They therefore recommended that additional gas-lamps of superior style should

be erected in Church Street. Mr. Myers opposed the Committee's recommendation, and presented a petition, signed by 94 ratepayers and shopkeepers on both sides of Church Street, in favour of the electric light. The signatories, he said, did not see why they should not have the same advantages as the tradesmen in Fishergate. His opinion was that the electric light was much superior to any other illuminant; and he believed the money would be well spent in extending it to the lighting of all the main thoroughfares in Preston. The Mayor (Alderman Edelston) pointed out that the Committee were acting in the interest of the general body of ratepayers, and proposed to effect a saving of £80 a year. Under the circumstances, it would, he suggested, be interesting to have the views of some of the gentlemen who were about to seek re-election to the Council, and who would have the economical aspect of municipal affairs brought under their notice. This challenge was taken up by Mr. Thompson, who seconded a resolution to the effect that Church Street be lighted by electricity. He remarked that, as one who had to seek re-election, he thought this should be done even at an additional annual outlay. In the course of further discussion, Mr. Hamilton stated that he did not regard the present lighting of Fishergate as satisfactory, on account of the dark shadows, which had caused several accidents recently. On a vote, the Committee's recommendation in favour of the better lighting of the street by gas was carried by 23 votes to 8.

THE MANAGEMENT OF THE STOKE GAS-WORKS.

The question with regard to the management of the Stoke Corporation Gas-Works (upon which a discussion recently took place in the Town Council, as reported in the JOURNAL for the 3rd inst.) has naturally been taken hold of by candidates for municipal honours, as a suitable subject on which to expatiate at the meetings of ratepayers. Two of the candidates—Messrs. H. M. Robinson and E. V. Greatbatch—referred to the matter at a meeting of burgesses last Wednesday. The former gentleman was brief in his remarks; but he expressed the opinion that he did not think the Gas Manager (Mr. Herman Taplay) had been treated fairly and squarely. He thought if they had a man occupying a position of confidence, they must either give him their confidence or else give him notice—there was no middle course between these alternatives. Mr. Greatbatch dealt in very strong terms with the question. He said that, if there was one thing more than another in the borough which largely touched the interest of the ratepayers, it was the management of the gas-works. For a number of years, the profits derived from the undertaking had relieved the rates very materially, and reduced the responsibilities of the burgesses. In 1881, the present Manager was selected as being the very best man available at that time for the position; and from then up till twelve months ago, the works were very successfully managed, though it was true some differences had arisen between Mr. Taplay and Alderman Faram—in fact, it was an open secret that very grave difficulties had occurred. Since 1881 the profits from the works had been effective in reducing the rates by some £33,000, repaying capital to the extent of £6000, while the price of gas had been reduced 6d. per 1000 cubic feet, to say nothing of a sum in credit of £4000; making altogether something like £45,000 obtained from the concern during the last twelve years. With such authentic figures as these, he asked, could any sane man contend for a single moment that a Gas Manager who produced such results was a fool? Last November Alderman Faram was elected to the chairmanship of the Gas Committee; Mr. Geen being appointed Vice-Chairman. A few weeks afterwards, the Committee bought 10,000 tons of coal totally in opposition to the judgment of the Manager. This coal was of a quality such as had never been used in Stoke before. No practical test whatever was made; and the purchase took place entirely on the strength of the statements of the vendor. Was that business management, or how should they describe it? As was naturally to be expected, the result turned out most unfortunate for the ratepayers; and the first thing the Committee did was to look out for a scapegoat outside their own select and immaculate circle. The speaker went on to condemn the action of the Committee in their treatment of the Manager. They had drawn up a report, in which they said there should be a change in the audit, and accused Mr. Taplay of not having given sufficient attention to his work; but they did not bring forward one fact to substantiate this charge. They also said the foreman—who happened to be the Manager's son—should be removed, as well as a junior clerk. The gentlemen who constituted this Committee were good business men he admitted; but they knew nothing about the management of a gas-works. The way they had obtained information behind the Manager's back, and formulated charges against him without affording him the slightest opportunity of rebutting them, he could only describe as most discreditable. Speaking for himself, he abhorred and detested anything so utterly un-English, so unmanly, and so unbusinesslike.

The Extension of the Salisbury Water-Works.—The extension of the Salisbury Corporation Water-Works, which was entered upon about twelve months ago, has now been completed. The old engine and plant, which were erected some forty years ago, have been supplemented by a more modern and powerful engine and improved machinery, capable of pumping 70,000 gallons of water an hour, as compared with 32,000 gallons pumped by the engine and apparatus previously in use. The new plant will be worked regularly; and the old engine will be kept in reserve for emergencies.

City of Rochester Drainage.—The scheme of sewerage and sewage disposal, submitted by Messrs. John Taylor, Sons, and Santo Crimp, for the Borstal portion of the borough of Rochester, has been selected by the Corporation as being the most suitable for the requirements of the district; and the Engineers have been instructed to submit the plans to the Local Government Board, in order that the necessary loan for the execution of the work may be sanctioned. There were a large number of schemes submitted in the competition; but the one adopted was unanimously agreed to be the best.

THE RISE AND PROGRESS OF THE BOLTON GAS-WORKS.

At Bolton, on the 21st inst., Alderman Miles, J.P., Chairman of the Corporation Gas Committee, delivered an address dealing with the rise and progress of the undertaking of which he has charge. At the commencement, he gave his hearers a brief outline of how gas is made, describing the various processes and apparatus used; following this up with some details about the original Bolton Gaslight and Coke Company, which was formed in July, 1820. The amount authorized by the Act of Parliament was £15,000, with borrowing powers for £7000; making a total of £22,000. The receipts for the first year came to £1328 19s. 8d.; and now the turnover at the gas-works is upwards of £120,000. In 1843 the gas supplied aggregated 25 million cubic feet; while for the financial year ending in March last, it was 783 millions—showing what enormous progress has been made since the gas-works were first established in the town. In 1843 the price of gas was 7s. per 1000 cubic feet; and now it is 2s. 8d., although it has been at 2s. 6d. Alderman Miles added that there was an agitation in some quarters for a reduction in price, and the making of less profits; but he pointed out that non-ratepayers within the prescribed two-mile radius would be getting an undue advantage. The surrounding townships had been invited to join the borough, but had refused; and he therefore said that the ratepayers within the borough should have as much relief as possible in lessened rates by reason of the profits made on the gas undertaking. Since the gas-works came into the possession of the Corporation, the sum of £199,587 had been handed over towards the relief of the rates. A reduction of 2d. per 1000 cubic feet would be like making outsiders a present of £2000 a year. There were 2530 public lamps in the borough, and 1527 in the out-districts; making a total of 4057. As a Corporation, they were the largest consumers; their account last year being £6500. They now employed 450 men, and paid in wages about £700 a week. Before concluding, Alderman Miles paid a warm compliment to the staff and men at the gas-works; adding that, owing to the unfortunate coal trade dispute, the Corporation already had paid about £4000 extra for coal.

THE HUDDERSFIELD CORPORATION AND THE LONGWOOD GAS-WORKS.

"There was wide divergence of opinion in the Huddersfield County Borough Council," writes a local correspondent, "on the question of purchasing the undertaking of the Longwood Gas Company [see *ante*, p. 769]. Under the latest extension scheme, Longwood—a straggling manufacturing village situated in one of the valleys to the west of Huddersfield—became incorporated with the county borough; and its inhabitants now want to enjoy the full benefits of the alliance. One of the obstacles in the way of complete incorporation is, however, the Longwood Gas Company, who possess statutory powers, and have for many years supplied the community with gas. Under the new conditions, the Company's position is a little anomalous; for while the Corporation supplying the rest of the borough are able to charge as low a price as 2s. 9d. per 1000 cubic feet, the Gas Company in this suburb charge 5s. Hence the agitation for the amalgamation of the undertakings and the reduction of the price of gas to the rate previously charged in the neighbouring districts. Some members of the Corporation—including, of course, those who represent Longwood—strongly supported the scheme of transfer which was suggested; while others, for various reasons, were against it. The Company do not appear to be at all anxious to sell; and, from the few remarks of one of the shareholders who is in the Council, it would appear that the price which the Corporation are disposed to offer may fail to meet the Company's idea of the value of the undertaking. That is, however, a mere matter of bargaining; and if negotiations were entered upon in earnest, no doubt a price would be ultimately agreed upon. One of the brilliant suggestions at the Council meeting was that the Corporation should acquire the Company's powers without taking over the works, which were, it was argued, unnecessary, as the Corporation had sufficient plant at their own works to make gas for Longwood as well as for the other districts. This is a pretty good idea in its way; but it was running very hardly the proposal of another gentleman, who figures as a "labour leader" in and out of the Council. His notion is apparently that the Corporation should insist upon taking over the works at the capital value, irrespective of the rate of interest or amount of dividend which the capital earns. For a £10 share entitled to a dividend of 10 per cent., he would give £10 and no more. To use his own words, 'interest had no doubt all along been paid on the money invested; and to give £17,000 over and above the capital was more than he was prepared to vote for.' It is surely a novel idea, even in these days of 'ransom,' that because a thing has been of profit to its owner in the past, it ceases to have value immediately it is coveted by another."

MANSFIELD CORPORATION GAS SUPPLY.

Annual Report.

At the last Meeting of the Mansfield Town Council, the Gas Committee's report for the year ending March 25 last was submitted and adopted. It stated that the period under review had been one of unusual difficulty and anxiety to the Committee, owing to the fact that the accounts for 1890-91 had shown a deficiency in the revenue account of £597; and, notwithstanding an advance in the price of gas made in September, 1891, the accounts for 1891-92 showed a deficiency of £1060. A searching investigation was made into the causes of the loss, and into the best means of remedying the state of affairs. It was found that, compared with other companies, the yield of gas per ton was 8500 cubic feet, as against 10,000 cubic feet; that in the depth of winter 110 mouthpieces were at work, when 70 ought to have been sufficient; that the labour account was consequently excessive; and that the quantity of coal carbonized was largely in excess of what it

should have been. This poor yield of gas was attributable to faulty setting of the retorts, to the low heat at which they were worked, and to the inferior quality of some portion of the coal used. Acting upon the resolution of the Council, Mr. W. Barrett, of Grantham, was engaged to enquire into the state of the works; and he reported that the setting of the retorts was improper, and the complete re-setting of the retort-house was recommended, at a cost of about £500. He also pointed out that the making of sulphate of ammonia was unprofitable, and that the condensing and scrubbing plant was insufficient. The attention of the Committee was drawn to the system of regenerative furnaces in use at the Eastcroft works at Nottingham. After interviews with Mr. W. R. Chester, the Gas Engineer of the Nottingham Corporation, and Mr. J. West, the patentee, an estimate was obtained for the reconstruction of the retort-house on this principle; and the works were placed in the hands of Mr. West to carry out, at a cost of £2698. Additional condensing power had been provided; and it would probably be necessary to supplement the washing and scrubbing apparatus at an early date. With regard to the accounts, the balance-sheets showed that on the revenue account a small profit had been made, which contrasted favourably with the two previous years; that the working capital amounted to £1369; that the sinking fund account stood at £8378; and that on the capital account £500 had been borrowed, and £409 expended—leaving a sum of £1669 to the credit of this account. The quantity of gas made during the year was 61,974,000 cubic feet; being an increase of 2,616,000 cubic feet.

THE GAS SUPPLY OF MONTREAL.

In our American Correspondent's "Notes" in the JOURNAL for the 17th inst., reference was made to the competing gas undertaking which has been started by Messrs. J. Coates and Co. for the supply of Montreal with gas. Some further particulars have since been supplied to us, from which we learn that the offer of the competing firm came before the Montreal City Council for consideration on the 25th ult., and, after being discussed at great length, was accepted by 24 votes to 10. The terms of the contract granted to Messrs. J. Coates and Co. are that they are to supply gas of 21-candle power at a price not exceeding $1 per 1000 cubic feet for ten years, with a reduction of 5 per cent. for prompt payment; that the privilege of furnishing gas during this term is to be subject to competition only on the part of the Montreal Gas Company; that after its expiration, and on the expiration of each subsequent period of five years, the City is to have the right, after six months' notice has been given to Messrs. Coates or their representatives within the twelve months preceding the expiration of the term of ten years, as well as a like notice of six months at the end of each subsequent five years, to acquire all their lands, pipes, manufacturing appliances and stock-in-trade, the price to be fixed by arbitration; that in the laying of pipes they are to be placed on each side of the streets permanently paved, or under the side walks; and that no charge is to be made for meters. In the specification on which the tender was submitted, it was mentioned that a deposit of $15,000 was to be made as a guarantee of the *bona fides* of the tenderers, and of the due fulfilment of the contract. It is arranged that the works of the new Company will be located at Cote St. Paul, near the Lachine Canal, and will cover an area of 3½ acres; the right being reserved of purchasing 3 acres more, if required. The land is adjacent to the canal; and the handling of coal and other materials will be facilitated by means of a tramway. Mr. Coates has arranged for a storeage of 1,750,000 cubic feet of gas per day. He has until May, 1895, to carry out his contract; but he has power to supply gas as soon as he is ready to do so. He has also obtained contracts for the supply of gas to Cote St. Antoine, St. Henri, and St. Cunegonde. A considerable portion of the plant will, we understand, be supplied from the Whessoe Foundry at Darlington.

The Plymouth Corporation and their Drake's Place Reservoir.—The Drake's Place reservoir at Plymouth has given the Corporation a good deal of trouble; and it is now likely that legal proceedings will be entered upon—the first step being taken at last week's meeting of the Council. The Water Committee's minutes stated that they had considered a report prepared by Messrs. Corderoy and Selby, in reference to the contract for the reconstruction of the reservoir; and they had resolved "that Counsel's opinion be taken as to whether the Corporation can recover—(*a*) The whole or any portion of £1703 overpaid to the contractors for the Drake's Place reservoir, and (*b*) damages, and, if so, from whom, by reason of the defective condition and faulty construction of the reservoir. And that, if it should appear from Counsel's opinion that the Corporation have any right of action against any person or persons, legal proceedings be instituted against such person or persons accordingly." The work, it was explained by Mr. J. T. Bond, was completed in August, 1891; £4716 being the amount originally sanctioned by the Local Government Board as intended to cover the outlay. Afterwards they authorized a further loan of £3017, to cover the sum spent on the reservoir and in laying out the adjoining grounds. Extravagant waste and leakage of water led to investigations being made, which resulted in the discovery of a leakage of 400,000 gallons a day from the reservoir. After reports by Mr. Mansergh and Mr. Faija, the Water Committee were instructed by the Council to place the matter in the hands of experts for report. The seriousness of the business was indicated in one paragraph of the experts' report referring to the butting of the joints, which was said to be 1 and 2 inches, instead of 4 inches, as specified; and, in their opinion, it was a serious discovery, dangerously affecting the stability and water-tight capacity of the reservoir, and in respect of which no pecuniary allowance could be made short of re-building, as no difference in the value of the work done and the amount specified could compensate for the structural defects. Mr. Bond having moved the adoption of the minutes, several members urged that the Committee should try to arrive at a settlement without going to law; but the minutes were eventually adopted.

CEARÁ GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Friday, at the London Offices, 9, Queen Street Place, Cannon Street, E.C.—Mr. HORATIO BROTHERS in the chair.

The SECRETARY (Mr. T. Guyatt) read the notice convening the meeting; and the Directors' report and the accounts (which were referred to in last week's issue) were taken as read.

The CHAIRMAN then moved the adoption of the report; and, in doing so, he compared the results of the working during the year with the preceding one. He said that the expenditure on capital account was £1137; and £419 had been written off for depreciation. The amount owing for gas rental and fittings was £643 over 1891-2; but the stocks in hand were £331 less. On referring to the revenue account, it would be found that coal cost £133 more. The quantity carbonized, however, was 136 tons greater; and the cost was 1s. 6d. per ton less. The average amount of gas sold per ton of coal carbonized was about 9600 cubic feet; while the quantity produced from each ton was 10,420 cubic feet—a result which might be considered very good. The manufacturing expenses, repairs and public lamps, and maintenance showed the small increase of £57, which, having regard to the increase in the quantity of gas made, was also very satisfactory. The expenditure on revenue account (eliminating the item of exchange from both years) exhibited an increase of £652, as compared with 1891-2. As a set-off against this, they received an additional £1043 for gas, and £238 for residual products. The receipts for fittings were abnormally high; being £2124, as against £935. The accounts showed that the working had been good, and reflected credit on the Manager (Mr. M'Making) and his staff. The item of exchange had increased considerably; and he (the Chairman) was afraid it was likely to still further advance in the present disturbed state of Brazil. The consequence was that in the past year it was a burden of 7½ per cent. on the capital, or, putting it in another way, 7½ per cent. on the capital must be earned before a penny could be paid as dividend—the Directors and officers being thus heavily handicapped in their endeavours to earn a modest dividend for the shareholders. It was to be hoped that this state of things would soon cease, and peace be restored in Brazil. Still, under these adverse circumstances, by good working and the reduced price of coal, the profit for the year had been augmented by £817.

Mr. J. DARELL BLOUNT seconded the motion, which was unanimously carried.

The CHAIRMAN next proposed, and Mr. A. J. KING seconded, that £500 be added to the reserve fund (making £5000 to the credit of that account), and that a dividend at the rate of 10 per cent. per annum on both preference and ordinary shares be paid—the dividend on the former class being less income-tax.

Mr. J. WRIGHT inquired if the Directors had considered the question of investing the reserve fund.

The CHAIRMAN replied that they were rather short of working capital; and, if they were to invest the fund at 3 per cent., while they were earning 10 per cent., there would be a loss.

Mr. KING remarked that they had spent £43,698 on investment out of £44,710 of capital. Therefore it was quite clear they were short of capital.

The proposition was agreed to.

The retiring Director (Mr. A. J. King) was then re-elected, on the motion of the CHAIRMAN, seconded by Mr. F. A. WALLWROTH; and Mr. Magnus Ohren was re-appointed Auditor, on the proposition of Mr. WRIGHT, seconded by Mrs. MIERS.

A vote of thanks was passed to the Chairman and Directors, on the motion of Mr. R. L. ANDREWS; and a similar compliment was afterwards paid to the Engineer, the Secretary, and the staff.

This concluded the proceedings.

COLONIAL GAS ASSOCIATION, LIMITED.

The Annual Meeting of this Company was held last Wednesday, at St. Clement's House, Clement's Lane, E.C.—Mr. H. L. HAMMACK, J.P., D.L., in the chair.

The SECRETARY (Mr. G. J. Gray) read the notice convening the meeting; and the Directors' report and accounts, which were epitomized in last week's issue, were taken as read.

The CHAIRMAN, in moving the adoption of the report, said the shareholders would notice that unfortunately the little cloud which at the time of their last meeting was only in the distance, but which induced the Directors to make a diminution in the dividend, had waxed into something very grave indeed; and, during the early summer, they had the financial crisis which seemed to threaten to some extent the good name of the Australian colonies. But there had recently been evidence that this was more or less passing away. If the shareholders looked at the item of bad debts, they would see that the Company had suffered very slightly indeed in consequence of the crisis. The amount was rather in excess of the year before; but it stood at the surprisingly moderate figure of £124. The severe depression, however, had made the consumers more economical than formerly; and this, combined with the fact that they had heavy floods at Brisbane (which added largely to the charges for carriage of coal, owing to a railway bridge having been carried away), had caused the diminution of profit. During the year, they had expended £5675 on coal, freight, wages, and repairs and maintenance, as compared with £5171 in the year ending June, 1892. On the other hand, the receipts for gas, residual products, &c., were £10,926, or a small percentage above the amount received the preceding twelve months. But the year's working had not brought them quite so much profit. However, the railway bridge to which he had referred had now been reconstructed; and they learnt from the last reports from their Superintendent (Mr. G. Swinburne) that there was a large reduction in the cost of coals. They might therefore look forward to next year being a promising one, though, of course, they would still to some extent feel the effect of the depression. In round figures, they had made a net

profit of £3200, out of which they had paid all the debenture interest and the interim dividend, and they had now available a sum which would enable them to pay a dividend for the past half year at the rate of 4 per cent. per annum, which would make a dividend of 4½ per cent. for the year. During the twelve months, they had issued debentures to the amount of £16,800, and 778 additional shares. The Company therefore appeared to have gained the confidence of the public; and the Directors hoped that the future dividends would be such as would justify them in continuing it. This was the fifth year's working; and the dividends declared during that time averaged 6·2 per cent., so that, on the whole, the investment had been a very fair one. It would be observed that considerable economies had taken place in the management expenses; and he believed there were very few companies paying such a dividend as they had done in which the Directors and Auditors only received £250. The income-tax, too, might be relieved a little by a recent legal decision, according to which dividends paid without reaching this country were not liable to English income-tax; and, if this was supported on appeal, they would save a small amount in that respect, as a large number of their shares were held in Australia.

Mr. G. H. HAYWOOD seconded the motion; and, in briefly referring to the depression in Australia, he observed that, when people lost money, they began to practise all sorts of economy, and consequently they had suffered among other companies. One did not like to make invidious comparisons; but, while their dividend was a slightly lower one, they could point to some large Australian gas undertakings whose dividends had dropped very considerably.

Mr. J. G. FARTHING pointed out that, in a circular he received last year, it was announced that a Stock Exchange quotation was about to be applied for; while in the present report it was said that the application had been postponed.

The CHAIRMAN replied that, at the time the report was issued last year, negotiations were pending for the acquisition of the Northern (Melbourne) Gas Company, the purchase of which was to be chiefly in shares. But, owing to some Municipal requirements with which the Directors were not willing to comply, negotiations had been suspended. Consequently the shares issued had not reached the number required for a quotation on the Stock Exchange. In answer to questions by Mr. Saward, the Chairman added that their Manager had been appointed the Liquidator of the Northern Gas Company; and, as to the loan to them of £3076, they were receiving 7 per cent. interest, and were sufficiently secured.

After further discussion, the motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. S. SPENCER, the dividend recommended was declared.

The retiring Directors (Mr. Haywood and Mr. W. C. Parkinson) and Auditors (Messrs. Alfred Lass, Wood, and Co.) were re-elected; and the services of the Local Committee, the Chairman and Directors, and the staff were duly acknowledged.

SERIOUS POSITION OF THE DUBLIN WATER SUPPLY.

For some time a large part of the south of Dublin has been placed on a supply of canal water from the filter-beds at the eighth lock of the Grand Canal, and the outlying townships have been limited to an intermittent supply of Vartry water, while the usual supply has been preserved on the north side of the city. These alterations have had a considerable effect; but the water in the Roundwood reservoir still continues to fall to a most alarming extent. Further restrictions have therefore become a matter of vital necessity; and the Corporation Water Committee were obliged yesterday week to decide that, on and after Friday last, the entire south side of the city should be placed upon a supply of canal water. As the water could not be obtained from this source at a sufficient pressure to admit of its being distributed on the north side, the Committee, after much deliberation, came to the conclusion that the supply of Vartry water must be restricted to four hours per day. After, however, considering a further report from the Engineer (Mr. Spencer Harty) on Thursday, they extended the hours of supply from 10 a.m. to 10 p.m. They also ordered that from Friday last the Vartry water should be turned off all other districts supplied save between the hours of 8 and 12 a.m. These precautions may possibly cause the continuous fall in the Vartry reservoir to cease, or so moderate it as to guarantee a supply under these limited conditions until rain falls. Meantime the Committee have under consideration the construction of temporary works, to enable a supply for the north side to be taken from the Royal Canal at a higher level, and so secure pure water should the drought continue. It is understood that, in consequence of the short supply, a stoppage of some of the large breweries and distilleries is imminent. The above decision of the Committee has given rise to much indignation among the residents on the north side of the city, and a considerable amount of newspaper criticism—it being contended that the temporary works which are "under consideration" ought to have been undertaken before the Vartry supply fell to such a serious extent.

The Price of Gas at Birmingham.—It is reported that, in consequence of the higher cost of coal and the diminished sale of gas during the past summer, the Birmingham Corporation Gas Committee contemplate raising the price by 3d. per 1000 cubic feet.

Alleged Lead-Poisoning at Mossley.—A Local Government Board inquiry was held at Mossley last Thursday, by Dr. Copeman, into the causes of lead-poisoning in the town. Evidence was given showing that, during the past eighteen months, a large number of cases had occurred, but that the rate of increase had been much greater since the water from the Greenfield reservoir was cut off, and the supply restricted to the Swineshaw reservoir some six or seven months ago. The consensus of opinion of the witnesses was that lead-poisoning was due not so much to the quality of the water as to the defective nature of the service-pipes. Ashton, Stalybridge, Dukinfield, and other adjoining districts are supplied with water from the same source; but no cases of lead-poisoning have been reported from these towns.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The past year's working of the Aberdeen Corporation Gas Department has turned out quite satisfactorily financially. There was a revenue of £70,251 from gas and meter rents; £9431 from residual products; and £200 from gas-stoves. There was expended £40,395 upon coal; £6341 upon wages; £2282 upon maintenance of plant; £2239 upon distribution of gas; £1899 upon management; and there was set apart for depreciation £3500—leaving a balance of £14,557. Out of this sum, however, there falls to be paid £5128 in annuities; £2463 of interest; £3476 is placed to the reserve fund; and £1000 is set aside for the redemption of annuities. These sums having been provided for, there is a surplus on the year's working of £1788. A year ago, however, a deficit of £2711 was carried forward; and the surplus which now arises is unequal to extinguishing that sum, there being still left £922 on the wrong side. Last year the Corporation advanced the price of gas from 3s. 8d. to 3s. 11d. per 1000 cubic feet; and their revenue from gas rose from £64,318 to £70,251. Residual products in 1891-92 produced £9843; but, on the other hand, coal cost £43,690. The Gas Committee have resolved to recommend that the price of gas be reduced again to 3s. 8d.; and they estimate for a revenue of £67,833 from gas, and £9500 from secondary products. The expenditure upon coal is estimated at £35,500. It is expected that the total expenditure will be £75,308, which will wipe out the existing deficit, and leave a surplus of £1103. It was reported to the Committee on Wednesday that the expenditure upon electric lighting account up to date had been £6234. There is a mortgage loan of £1800; and the balance due to the gas department is £4434.

The Aberdeen Corporation Gas Committee have this week let the construction of the large gasholder—of 5 million cubic feet capacity—which they are about to erect at the Links, to the Barrowfield Iron Company, of Glasgow, the firm who built the large Glasgow holder. The contract price is £21,200.

Certain newspaper writers are this week professing to have just discovered that gas can hold its own with electric lighting in the matter of cost. It does look surprising that it should have been necessary to educate such persons; but I suppose it is to be accounted for by the persistence with which the so-called progress of electric lighting is dinned into the ears of the public, that the belief is common that electricity is cheaper than gas. The occasion of the present remarks has arisen in connection with the lighting of a new lunatic asylum at Hawkhead, between Glasgow and Paisley. It had been taken almost as a matter of course that the asylum would be lighted by electricity; but when the Building Committee looked into the matter of cost, they changed their mind. They had estimates prepared, which showed that the cost of lighting by electricity would be £5300, with an annual outlay of £635; by oil gas, £2810, with an annual expenditure of £282; and by Glasgow gas, £1500, with an annual outlay of £200. It has therefore been resolved to introduce Glasgow gas. Gas has thus been established in the West of Scotland in its rightful position. Not only has it won on its merits, but it was also preferred on the ground of being safer. The Governors contemplated with dismay the prospect of the whole asylum being thrown into darkness by a mishap to the light. "Such a misfortune," one of them remarked, "took place in one of the libraries lighted with electricity; and the place had to be cleared." Of course, the difference was that they could not clear a lunatic asylum of its inmates if the light failed. There is an incident connected with the matter which relates to gas alone. The new asylum is situated so that it might be served from either the Glasgow or the Paisley gas-works. Application was made to the Corporations of both places for quotations for an installation of from 1200 to 1500 jets. It has not transpired what the Glasgow offer was; but the Paisley Corporation, at their last meeting as Gas Commissioners, resolved to offer gas at 3s. 6d. per 1000 cubic feet, on condition that it was taken for at least ten years, and that the rate should rise and fall according to the rise or fall within the burgh, where the price of gas is at present 2s. 8d. per 1000 cubic feet. The Glasgow offer must have been more favourable.

The statement in the above paragraph is accentuated by two other incidents which have come under my notice. In the first, it will be remembered that more than a year ago the people of Dufftown, a small town in the highlands of Banffshire, were persuaded to sell their gas-works by the promise that electric lighting would be provided for them at a smaller cost than gas had been. The gas-works have been abolished, but the electric light has not come in; and the other day a public meeting was held, at which a Committee was appointed to take the opinion of a gas engineer as to the cost of erecting new gas-works, and to look out for a site for them. I should say that the inhabitants of Dufftown have had, in the matter of lighting, an object lesson rubbed into them which they will not soon forget. The other incident relates to a much more important place—the county town of Stirling. There it was mentioned by Bailie Mercer the other night, at a meeting of electors, that "a private company had offered to lay down electric plant and to supply light at a price rather under that of gas." Bailie Mercer seemed to believe it to be possible to do such a thing; but Provost Kinross did not. In fact, his remarks were so sensible that I give a sentence or two of them. "With regard," he said, "to electric lighting, I cannot give you any information. I have no objection to seeing it introduced into Stirling to-morrow; but as I hold that experience is the best teacher, I have tried to get as much information as possible as to the success or non-success of electric lighting in those towns where it has been introduced, and the information I have got is at the disposal of the Committee. I am sorry to say it is not so favourable as those who are anxious to see the electric light in Stirling might expect; but the offer we have got from a private company is certainly a favourable one." The Provost holds an unbiassed mind, which, on this subject, I, like him, am sorry to say is somewhat rare.

The same subject of the comparative cost of gas and electric lighting is cropping up at numerous meetings of electors, as the result of the endeavours which are being made by speculative companies to force municipalities into the adoption of the latter. At Hamilton, Provost Wylie said it would be a loss to them, unless they were to

close their gas-works and compel everybody to become consumers. He also stated that a friend of his in Dundee, where gas was sold at 3s. 9d. per 1000 cubic feet, had told him that electric lighting cost him 40 per cent. more than gas; and that in Hamilton, where gas was 2s. 11d., electric lighting would cost 50 per cent. more.

It must be confessed that a good deal that is talked by town tcouncillors who are in charge of gas-works at municipal election imes, only serves to show the nebulous state of mind many of them are in upon gas matters. Thus, Provost Wylie, of Hamilton, informed the electors of that burgh that "oil gas had been spoken of, and very nearly adopted; but on account of the reduction in the price of coal, they thought it better to make further inquiry. He thought it was well they had not gone in for it, because it had come to his ears the other day that oil gas choked the pipes; and had it been adopted, very possibly in a few years they would all have required to renew their pipes." Of course, there are several oil-gas systems; and some of them may condense in the pipes. If he referred to the Peebles process, he was merely talking nonsense. With it, it has been already proved that, not only is there no condensation in the mains and service-pipe, but, unless when tar is being carbonized, there is no difficulty from choking of the plant in the works. Another subject on which the Hamilton Provost seemed to be at sea, was that of the manufacture of sulphate of ammonia. He admitted that a profit of between £200 and £300 might have been got from it. But then the Alkali Act would have been likely to come in to bother them; and "he understood there were certain fumes that came off the tar, or rather pitch, when it was hot, that were very dangerous."

The Town Council of Falkirk have taken up a curious position with reference to the lighting of a lamp at the door of the Post Office. Government have provided the town with a new Post Office; and the postmaster requested the Council to remove a specially constructed lamp from the old to the new premises. The Council were quite willing to remove the lamp; but they have laid down the condition that the Postmaster-General must pay for the gas which it consumes. This resolution can only be justified on the assumption that the Post Office exists for the benefit of the Post Office, and that extra light about its doors would bring extra business to it. Such an assumption is not tenable. The Post Office exists for the benefit of the community; and if the public street in its neighbourhood be kept dark, it is the community, not the Post Office, who will be inconvenienced.

One more reference to electric lighting. The Lighting Committee of the Aberdeen Town Council have resolved that eight arc lamps for street lighting are to be erected. But their resolution is also that these lamps shall be extinguished at midnight, and that then the existing gas-lamps will be lighted. Surely this is an absurdly expensive mode of lighting. It means no reduction whatever upon the gas lighting, except a few thousand feet of gas; and that the cost of the electric lighting will simply be an addition to the present charges. Why not have the same system of lighting, whatever it should be, for the whole of the night?

The Dunbar Gas Commissioners had before them on Thursday a letter from Messrs. Bruce, one of their coal contractors, intimating that, on account of the difficulties with the miners, they could not supply coal at the contract price of 11s., but would supply it for 13s. 6d. per ton. At the same time, the Clerk produced a telegram, sent from Glasgow, in which coal was offered at 13s. 3d. per ton. Some indignation was expressed that it should have been known to anyone that the coal contract was to be repudiated, and a new quotation made; but no one could explain it. It certainly looks a somewhat questionable transaction. The Commissioners resolved to take no notice of the telegram, but to ask another firm to give a quotation for coal. Is this to be a singular instance of the breaking of coal contracts, or are others to follow?

It may interest some of your readers to learn that, at the annual meeting, on Wednesday last, of the Glenboig Fire-Clay Company, Limited, though the Chairman (Mr. John Wilson, M.P.) complained of the depressed condition of trade, and the getting of business at unremunerative rates, they were able to pay a dividend at the rate of 5 per cent. The gross profits on the past year's work amounted to £12,933; but £4000 was written off for depreciation—leaving the net profit at £8933. The Company, the Chairman said, were now beginning to derive benefit from the alterations they had from time to time made upon their works, with a view to lessening the cost of production of their goods.

Water Companies' Dividends.—The Directors of the Monte Video Water Company have resolved to pay an interim dividend at the rate of 5 per cent. per annum, free of income-tax. A similar interim payment is to be made to the shareholders of the Kimberley Water-Works Company.

The Bolton Gas Committee and the Electric Light.—A discussion arose at the last meeting of the Bolton Town Council as to the manner in which the accounts of the Electric Lighting Department are to be kept, and, incidentally, as to the future control of the department. Hitherto the Gas Committee have carried out all the arrangements; and at their last meeting they decided that the accounts should be kept in the same manner as those of the Gas Department, and by the same staff, but that a separate banking account should be opened. Objection was taken to this by Alderman Barrett, who suggested that a Committee should be appointed for the management of the whole of the accounts. He said he believed that public confidence would be strengthened if this were done, and that it was undesirable that the same Committee should deal with both gas and electricity. Alderman Miles, Chairman of the Gas Committee, was strongly of opinion that the electric lighting accounts should be kept in the same form as the gas accounts, seeing that both would be paid at the same counter. As to the management of the works, the Gas Committee had had the control of the electric lighting arrangements from the commencement; and it would be ungrateful for the Council to take the work from them, unless some grave reason arose. The two departments would not clash, for the Gas Committee were determined that the electric light should have full and free limit and fair play. The Council confirmed the Committee's proceedings.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 28.

Sulphate of Ammonia.—It seems strange to observe the hallucinations consumers will give way to, under the influence of misrepresentations of the market. Well primed by the speculators as to the hopelessness of future prices, there is hardly a consumer who will come into the market at present, in the belief that by his abstinence, the market must collapse, and that the longer orders are withheld, the lower prices will be driven. Advice to the contrary under such circumstances is useless; and, if these buyers were told that the operators knew in their hearts the dangerous maze they are treading, they would probably decline to believe it. So the market must take its course. In the meantime, very few makers are inclined to enter into future contracts; and the forward business, such as there is, is entirely done by the "bears," who do not hesitate to offer on the basis of about £12 10s. right away into spring. Another surprise may, however, be in store both for consumers and speculators before the end of the year, if the present estimates of the statistics prove to be correct. Spot prices are irregular; and there is generally a wide gap between the prices asked by makers and quotations of the speculators. There are, however, no buyers just now above £12 12s. 6d. Nitrate is quiet at 9s. 1½d.

LONDON, *Oct.* 28.

Tar Products.—The slight improvement in the value of benzol and pitch noted last week is maintained. So far as benzol is concerned, buyers evidently think bottom has been touched. Creosote and common oils continue scarce; the demand for fuel purposes having cleared out most makers' stocks. There is a better feeling in regard to carbolic acid; and, in the absence of any important stocks, this article ought to improve. The average values of the week may be quoted at: Tar, 16s. to 17s. Pitch, 26s. 6d. to 27s. 6d. Benzol, 50's, 1s. 7d.; 90's, 1s. 6d. Creosote, 2¼d. Creosote salts, 30s. Solvent naphtha, 1s. 3d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 8d. Carbolic acid, 60's, 1s. 4½d.; crystals, 5⅜d. Cresol, 1s. 2d. Anthracene, 30 per cent., "A," 1s. 2d.; "B," 10d.

Sulphate of Ammonia.—There are more inquiries, though little new business is reported. A determined effort is being made to depress the value of sulphate; and, unless manufacturers are discreet, prices may fall further. Sulphate of ammonia is not only wanted, but must be had by users so long as the price is not outrageously high. Stocks keep remarkably low; and, if makers refrain from hawking their stuff round the market, a distinct improvement would at once be seen. Prices mentioned during the week have ranged between £12 5s. and £12 15s., less 3½ per cent., according to position and conditions of delivery; while gas liquor is selling at 7s. to 8s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Now that representatives of both the Coalowners' and Miners' Federations are enabled to meet to discuss the whole question, without any prejudice to either side, there is at length the probability that some settlement may be come to; although, if there is to be a general resumption of work, the acceptance by the men of some reduction in wages seems to be almost absolutely necessary. At any rate, the leading colliery concerns throughout this district continue exceedingly firm in their determination not to reopen their pits until the men agree to some reduction in wages; and unless the settlement at the forthcoming conference is to be on this basis, there is the probability that a large number of the principal collieries in Lancashire may continue closed for a considerable time longer. The general feeling, however, is that the end of the dispute is approaching; and, with plentiful supplies of all sorts of fuel in the market, prices have begun to decidedly ease down. This has been especially the case in the better qualities for house-fire purposes; the delivered rates for which have been reduced during the past week 2s. 6d. to 3s. 4d. and 4s. per ton. Gas coals have also been easier to buy, as large supplies have been coming in from Scotland and other districts; and at the collieries that have restarted in Lancashire the maximum rates obtainable at the pit mouth have been 19s. and 20s. per ton. Prices such as these are, of course, only being paid to secure temporary supplies, to keep gas-works going until they can obtain deliveries under ordinary contracts; but they have entailed so much increase in the cost of production, that a very general movement is going on throughout the district for advancing the price of gas to consumers. Manufacturing classes of fuel have so far not given way to any very appreciable extent. Engine fuel, at the pit mouth in Lancashire, has been quoted at 16s. to 17s. per ton; while for similar qualities of fuel coming in from outside districts, the prices at the stations and wharves have averaged 18s. to 19s. Steam coals are 21s. to 22s. per ton.

Northern Coal Trade.—The demand for coal in the North-eastern district, though still a very full one, is not so intense as it was; and the output seems to be rather larger, because there is not that interruption to work that there was a month or so ago. All the collieries are working full; and for some kinds of coal the demand is still above the available supply. Best Northumbrian steam coals are very firm, because there is not only the demand from the Midlands, but the late shipments to the Baltic and to northern ports are now being pushed rapidly forward. The price varies with the different collieries; but about 14s. per ton f.o.b. is the rate that is most frequently quoted, though higher prices have been paid to secure prompt supplies. Second-class steam coals are about 1s. to 1s. 6d. per ton lower than best; whilst small steam coals are firm at from 6s. to 6s. 6d. per ton. Gas coals are in very keen demand; and the price seems rising, though there is still an enormous quantity that is being delivered on old contracts at the low price of 6s. per ton. For small lots for prompt delivery, 12s. per ton has been asked and paid; and there is a difficulty to obtain supplies even at that high figure. Durham small has been sold at 9s. per ton for gas-making purposes. The scarcity is, however, partly due to the fact that this class of coal has been rather freely sent for other

uses into the Midlands. Manufacturing coal is firm, with a good outside demand. Blast-furnace coke is a little steadier, with a good demand; whilst best Durham kinds for shipment are now quoted 16s. per ton f.o.b. There was no alteration during the past week in the price or the extent of the demand for gas coke. Fuel generally would speedily feel the effects of any settlement of the strike in the Midlands; and with a lessening area of the dispute, it is to be expected that such a termination cannot now be very far off.

Scotch Coal Trade.—The coal system of Scotland is being worked harder than ever, to make up for the lack of supply from the English pits. Things are proceeding smoothly in the West and in Fifeshire, where, in the meantime, the men are content with their earnings. In the Lothians, the men have resolved upon a four-days-a-week policy; and this has led to the reprisal, at the Newbattle Collieries, of the locking out of 700 men. The Lothian Coal Company, who are owners of the Newbattle pits, are not connected with the Coal-masters' Association; and their action is thus individual. The Association, however, have, through their Secretary, intimated to the miners that, if a further advance is demanded, the masters may have to take measures for their own protection. As is well known, the Newbattle Collieries provide a large amount of the cannel consumed in gas-works; and the lock-out, if it continues, may affect gas supply in some places. For the coal which is being disposed of at present, high prices are being obtained; but the effect of this is largely counterbalanced by the great quantity which was contracted for before the strike, at very low rates. For instance, splint is selling at 11s.; but the Glasgow Corporation are only paying 7s. 3d. for it, under contract. Quotations are, therefore, less to be relied upon than usual, as an indication of what the coalmaster is earning. For this week they are: Main, 10s. to 10s. 6d.; ell, 10s. 9d. to 11s.; splint, 10s. 9d. to 11s.; and steam, 11s. per ton f.o.b. Glasgow. Shipments were again very large, amounting to 212,098 tons—a decrease, as compared with the preceding six days, of 24,229 tons; but an increase upon the corresponding week of last year of 40,461 tons. For the year to date, the total shipments have amounted to 6,203,078 tons, which brings the figures to within 12,495 tons of the abnormal shipments of last year up to this time.

THE EFFECT OF THE COAL STRIKE ON LANCASHIRE GAS UNDERTAKINGS.

Our Manchester Correspondent writes: Although there is now less difficulty in getting supplies of fuel than there was before the partial resumption of work, the prolonged strike is having a disastrous effect on the finances of Lancashire gas undertakings. The stoppage has continued so long that even the largest stocks of coal and cannel are exhausted; and it is already announced in several towns that an advance in the price of gas will be the inevitable result of the expensive purchases which have had to be made in the open market. At Liverpool, the consumers are warned that the price will be increased after the end of the year. In Manchester, the Gas Committee had a large stock of coal; but this is now exhausted. At a meeting of the City Council on Wednesday, the suggestion was seriously made that only half the street lamps should be lighted, with a view to economizing the use of gas. Mr. Heywood, who proposed this, stated that the lighting of the streets was costing £100 per day, instead of £50 as usual; but Mr. Brooks, the Chairman of the Gas Committee, could not be induced, even by the prospect of so considerable a saving, to incur the odium of lighting the streets less efficiently than at present. A statement as to the cost of the coal and cannel recently purchased was made by Mr. J. Noden, the Chairman of the Stockport Gas Committee, on Wednesday. The Committee asked the Town Council to sanction the purchase of coal at prices varying from £1 0s. 6d. to £1 10s. per ton; and Mr. Noden took the opportunity of stating that their purchases of coal and cannel amounted to 5096 tons, at an average increase in price of 9s. 4d. per ton. This amounted to £2378, and represented, upon the present consumption, an increase in the cost of fuel of £466 per week, allowing for the increased receipt from coke of £60. They were able to tide over the first twelve weeks of the strike, as they had a sufficient quantity of fuel on hand; but the strike was now costing the Gas Committee at least £400 a week, and this would increase as the strike continued. The Bury Town Council decided on Thursday to advance the price of gas 4d. per 1000 cubic feet. Mr. Byron, the Chairman of the Gas Committee, reminded the members that gas had been sold at as nearly cost price as possible, and that last year, owing to the strike in the cotton trade, and to the interest and sinking fund on the amount expended on the new railway siding, there was a loss of £919. The price of gas was then raised 1d. per 1000 feet; and it was thought that, by taking a sum from the reserve fund, the Committee would be able to make ends meet this year. The coal crisis had, however, considerably interfered with their estimate. At the commencement of the dispute, they had only about 2000 tons in stock; and they had had to buy coal and cannel as best they could—the result being that there was a loss of about £500 per week. Burnley is another town where the difficulty is severely felt. The Chairman of the Gas Committee (Alderman Collinge) even went the length on Wednesday last of congratulating the Council on the fact that there was a decrease in the consumption of gas. The falling off for the past month was 3,342,000 feet, or 13·2 per cent.; and as gas is being manufactured at a great loss, the lessened consumption was really beneficial. Burnley, it appears, had eight weeks' supply of coal and cannel on hand when the strike occurred; and they have since had to buy it from Durham and elsewhere. The additional cost to the Corporation is about £500 a week; and Mr. Collinge warned the Council and the consumers that this loss could not be continued long without an increase in the price of gas. The Committee's difficulty was, he pointed out, to get sufficient fuel to keep up a fair supply of gas, and at the same time not to run the risk of having 4000 or 5000 tons of dear coal on hand when the strike ends—a difficulty which is increased by the fact that coal-trucks had taken three weeks or more in journeying from Burnley to the Northern coal-field and returning thence full of coal. The subject of the coal supply and its effect on the gas-works was also referred to at a meeting of the Rochdale Town Council on Thursday. Alderman W. J. Petrie, the Chairman of the Gas Committee, in replying to a question, said the position was still very uncomfortable. For some time, they found great difficulty in getting coal delivered; but, during the past few days, this had lessened, and coal was now being showered upon them. They had 22 horses and carts engaged in bringing coal from the railway siding to the gas-works, and were about to employ more. He hoped they would be able to pass through the crisis without reducing the supply of gas; but it might be necessary to raise the price. This, however, was a course which they would be very reluctant to take. The profit which they were in the habit of making had already been swept away; and, of course, the longer the high price of coal was maintained, the greater would be their difficulty. The Committee, he added, had more than maintained the illuminating power of the gas; for they had been compelled to buy a better class of coal than they usually carbonized—coal which was too rich for the purpose, and too costly. As to the cost of the strike to Salford, one of the councillors who is seeking re-election stated on Tuesday last that the enhanced price paid for coal up to that time was £7128. The Gas Committee had obtained £1006 by increasing the price of coke; but the loss to the borough was still £6122, and it would be for the ratepayers to decide whether this should be met by additions to the rates or by advancing the price of gas.

Prospective Further Increase in the Price of Gas at Liverpool.—The Directors of the Liverpool Gas Company have decided, in view of the enhanced price of coal and the additional expenditure thereby incurred, to still further increase the price of gas, which now stands at 3s. per 1000 cubic feet. The increase will probably come into operation at the beginning of next year.

Richmond and Co., Limited.—The report of the Directors of this Company for the year ending the 30th ult., with the accounts, was presented to the shareholders at their third annual meeting yesterday. The accounts include some heavy payments incurred in bringing the Company's manufactures more prominently forward; but the Directors look for compensating benefit in the not-distant future for this outlay and similar previous expenditure. There is shown a sum of £1770 in hand on the trading account; and out of this it was proposed to pay a dividend of 5 per cent. per annum (free of income-tax). This would absorb £815, and leave a balance of £955 to be carried forward. The Company's gas cookers and fires are employed by The Gaslight and Coke Company; and a cooker specially designed for hiring out free with prepayment meters has just been adopted by the South Metropolitan and Brentford Gas Companies.

The Manchester Gas Committee and the Sale of Coke.—On the minutes of the Gas Committee being presented for adoption at the meeting of the Manchester City Council last Wednesday, Mr. Wells said he had hoped the Chairman of the Gas Committee (Mr. Brooks) would have referred to a question which was agitating the public mind—viz., the sale of coke. If the Committee had been selling coke up to the present at an enhanced price, they had been doing so at a profit, because they had not until now had to buy coal at the higher prices. He pointed out that there was a resolution of the Committee that the members could have supplies of coke at half price for distribution to the poor. He only mentioned this to meet the argument raised by the Chairman in committee that they had no right to be benevolent with other people's money. This argument, he thought, fell to the ground, because they had been generous in the past. He knew it was a difficult thing to do; but, if arrangements could be made for poor people to obtain coke during the strike, it would be a great benefit to them, and would bring credit to the Committee. Mr. Brooks replied that the Committee had very carefully considered the coke question. They claimed as much sympathy with poor people as anyone in the Council; but the difficulty was the impracticability and absolute impossibility of carrying out equitably any such arrangement as was suggested. They had endeavoured, as far as possible, to establish a plan whereby coke could be supplied to small consumers when those who had contracts with the Committee for coke had been supplied.

The Powers of the Portsmouth Water Company.—At the Portsmouth Police Court last Friday, William Holder, of Harold Road, Southsea, appeared to answer two informations laid under section 17 of the Portsmouth Water-Works Company's Act, 1872, for refusing to allow Henry Miller, an officer of the Company, to make an inspection of 9 and 11, Fratton Street, for the purposes of the Act, on Sept. 12 and 26. Mr. Douglas Ford, Solicitor, appeared in support of the information. He said that defendant was charged with a breach of the Portsmouth Water-Works Act, in respect of the inspection of water-fittings. By the Act, the Company were placed under serious responsibility in regard to the maintenance of a constant supply; and, in order that they might be able to perform their contract, they were given necessary powers of inspection and examination for the purpose of checking waste of water. Section 17 provided that an officer of the Company or the Corporation might enter any building to inspect or examine the same, and that any person who hindered such officer should be liable to a penalty not exceeding £5. It became necessary that these proceedings should be instituted, because the defendant had persistently refused to allow the inspectors to examine his premises. Since the summons had been issued, however, wiser counsels had prevailed; and the defendant had intimated to the Secretary of the Company that he would be prepared to have his premises inspected. An inspection had now taken place; and the object of the Company had been thus attained. Under the circumstances, he did not propose to press the case. The Company were all the more ready to take this course, as though the Act had been in force for twenty years, this was the first occasion the Directors had had to take proceedings to enforce it; and, in fact, since the incorporation of the Company in 1857, they had not until now come before the Magistrates either as complainants or defendants. Sir William King, addressing the defendant, said the Magistrates were glad that he had seen the mistake he had made. Unless the Company had proper control, the supply of water might be jeopardized. The summons was then withdrawn.

Increase in the Price of Gas at Willenhall.—The Willenhall Gas Company have announced their intention of advancing the price of gas by 3d. per 1000 cubic feet from the 1st prox.

Dewsbury and the Electric Light.—The Local Government Board have sanctioned the borrowing of £25,000 for an electric lighting installation at Dewsbury, and have approved of the use of the old gas-works site at Batley Carr for a central station.

Louth Gas Company.—The net profits of this Company for the past financial year amounted to £2391, out of which dividends of 13¾ per cent. on the ordinary capital, 5 per cent. on the improvement stock, and 10¾ per cent. on the new ordinary 1877 stock have been declared.

Continued Scarcity of Water at West Hartlepool.—Some time ago, the Hartlepool Gas and Water Company, owing to the continued drought, reduced the supply of water for manufacturing purposes to fourteen hours per day; and on Wednesday last, they still further curtailed it to six hours a day. It is stated that no rain has fallen in the district for several weeks.

The Failures of Electric Lighting in the City of London.—At the last meeting of the Commissioners of Sewers, it was agreed, on the motion of Mr. Burmester, that a report should be prepared by the Engineer (Mr. W. Haywood, M.Inst.C.E.), showing what failures of the electric light occurred in the past quarter, and on what occasions gas had been used in substitution.

Projected Extension of the Blackburn Gas-Works.—At a meeting of the Blackburn Town Council held last Thursday, it was decided to apply for a Provisional Order to extend the provisions in the Blackburn Improvement Act with regard to the gas undertaking. The Corporation desire powers to erect new gas-works and manufacture gas upon land on the southern side of the Blackburn and Accrington Railway, and to raise on loan the capital required for this purpose.

Alleged Gas-Works Nuisance at Shoreditch.—At last Tuesday's meeting of the Shoreditch Vestry, the Parliamentary Committee reported that they had considered the recommendations contained in the joint report of the Vestry Clerk, Medical Officer of Health, and Chief Sanitary Inspector, and recommended the Vestry to engage Mr. J. W. Helps, of Croydon, to thoroughly examine the gas-works at Whiston Street, and make a report thereon for the sum of £15 15s. This was agreed to.

Additional Gasholder Accommodation at Rotherham.—During the past ten years, the quantity of gas consumed in the Rotherham district has grown from 105 million cubic feet to 153 millions; and this has necessitated considerable extensions at the Corporation gas-works. Among these has been the enlargement of one of the holders. This originally had a capacity of 450,000 cubic feet; but it will now contain about 1 million feet. Two lifts have been added; making four altogether. The guide-framing (which has been reconstructed) controls the three lower lifts; and the top one rises above the columns. The plans and specifications for the work were prepared by the Engineer (Mr. C. B. Newton), under whose personal supervision the work was carried out.

The Dunedin Suburban Gas Company, Limited.—In the annual report of this Company for the year ending June 30 last, the Directors say it is satisfactory to note that the revenue account, after writing off the debit balance (which at June 30, 1892, amounted to £222) shows a balance of profit to the credit of that account of £119, which they propose to carry forward to next year. Although the volume of business has not progressed during the year as much as the Directors would have liked, there are, according to recent advices received from the colony, encouraging indications at present of development in the districts served by the Company, particularly in the suburbs of Caversham and Mornington, which the Directors hope may result in an increase of the supplies of gas in these districts at an early date.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 798.)

Issue.	Share	When ex-Dividend.	Dividend or Int. or Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	16½—17½	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	11½—12½	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102—104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	12 May	6½	Bombay, Limited	5	5⅝—6	..	5 8 4
40,000	5	,,	6½	Do. New	4	3¾—4¼	..	5 13 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	220—225	..	5 2 2
180,000	,,	,,	8½	Do. New	100	165—170	..	5 0 0
220,000	20	15 Sept	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	42—44	..	5 4 7
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	6–7	+⅛	2 17 2
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97—100	..	6 0 0
150,000	20	13 July	8	Cagliari, Limited	20	26—28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	245—250	..	5 0 0
165,000	,,	,,	9½	Do. New do.	100	187—192	..	4 19 0
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref	100	191—196	..	5 2 0
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	21—22	—⅛	4 10 11
354,060	10	,,	10	Do. Partly paid	7½	14½—15½	—⅛	4 17 0
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	223—228	—3½	5 5 3
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97—102	+2	3 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	263—268	..	3 14 7
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	183 –188	+3	3 19 9
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	173—178	..	3 18 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	262—267	..	3 14 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	157—162	..	3 14 1
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	12 May	12	Imperial Continental	100	225—230	–2	5 4 3
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5—5½	—¼	5 9 1
560,000	100	2 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	104—106	..	4 14 2
541,920	20	15 June	5	Monte Video. Limited	20	12¾—13½	..	7 8 2
150,000	5	31 May	10	Oriental, Limited	5	7¼–7¾	—⅛	6 9 0
60,000	5	29 Sept.	7	Ottoman, Limited	5	4–4½	..	7 15 6
166,870	10	—	2	Pará Limited	10	1½—2	..	—
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98—102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8½—9½	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	304—309	..	5 0 4
1,350,000	,,	,,	12	Do. B do.	100	248—253	..	4 14 10
260,000	,,	,,	13	Do. C do.	100	258—263	—1	4 18 9
750,000	,,	13 July	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	31 Aug	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	270—275	..	3 12 9
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	215—220	..	3 12 9
544,440	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140—143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	114—118	+1	3 12 0
708,000	Stck.	16 Aug.	11	Kent	100	285—290	..	3 15 10
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	245—250	..	3 16 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	199—204	..	3 13 6
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares	100	335—340	..	3 11 4
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132–135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	155—160	..	3 15 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	145—150	..	4 0 0
1,155,066	Stck.	15 June	10	West Middlesex	100	262—267	..	3 14 10

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

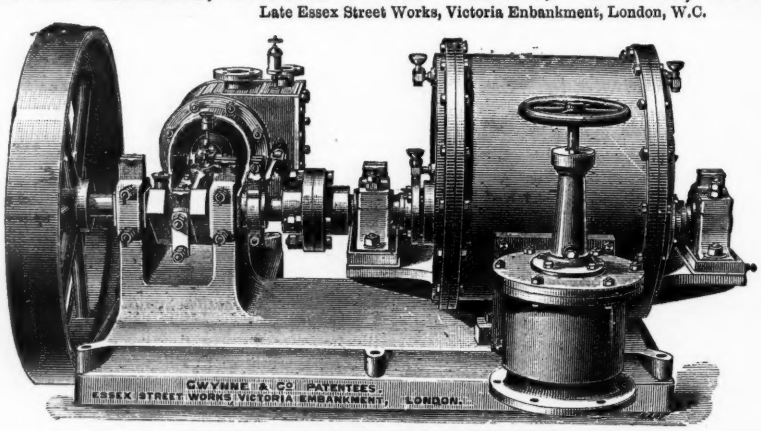
Late Essex Street Works, Victoria Enbankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEAR DALKEITH, }

WANTED, a job as Gas-Fitter, Service LAYER, METER FIXER, &c.
Apply to THOS. RENDLE, Gas-Fitter, 19, Portland Street, ILFRACOMBE.

WANTED, by the Advertiser (aged 29, and total abstainer), a Situation on a Gas-Works as ASSISTANT to Engineer or Manager, or Bookkeeper. Six years in present Situation. Speaks Portuguese thoroughly. No objection to go abroad. Will be disengaged by end of January, 1894. Good references.
Address No. 2293, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas-Fitter, well up in Stoves, Fires, Regenerator Burners, &c.
Apply, stating experience and wages required, to No. 2294, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Working Gas Manager for the Kirkby Stephen Gas Company. He must be able to take Meters, lay Service-Pipes, and do all Work connected with Gas Making. Wages, 24s. per week, with House, Coal, and Gas free.
Applications, with testimonials, to be forwarded to Mr. L. FAIRER, KIRKBY STEPHEN.

TAR-TANK Railway Waggon wanted, to hold about 10 tons. Second-hand, if in good condition.
Address J. ELY, Gas-Works, ABINGDON.

THE Madeley Coal and Iron Company, Limited, Madeley, near Newcastle, North Staffordshire, have some GAS COALS to sell. Prompt delivery.
Telegraphic Address: "SETTLE, MADELEY, STAFFS."
Agents South of Stafford: Messrs. J. HACKETT & Co., LEAMINGTON.

SPECIAL BARGAIN.

FOR SALE—A perfectly new 30,000 feet per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
The whole of the above plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BRISTOL GAS COMPANY.

TENDERS FOR TAR.

THE Directors of this Company invite TENDERS for the purchase of the TAR to be produced at all or either of their three Stations, during a period of One year, commencing on the 1st day of January, 1894.

The annual quantities of Tar produced at each of the Stations at present are, approximately, as follows:—

Avon Street	650,000 gallons.
Canons' Marsh	550,000 "
Stapleton	650,000 "

Further Particulars, with Forms of Tender, may be obtained on application to the undersigned, to whom also tenders, sealed, and endorsed "Tender for Tar," must be delivered not later than Ten a.m., on Monday, the 13th day of November prox.

JOHN PHILLIPS,
Secretary.

Chief Offices: Canons' Marsh,
Bristol, Oct. 4, 1893.

Just published, Price 7s. 6d.

THE REGISTRATION OF TRANSFERS
Of Transferable Stocks, Shares, and Securities;
With a chapter on the Forged Transfers Acts, and an Appendix of Forms for Directors, Secretaries, Registrars, and Officers of Public Companies and other bodies.
BY GEORGE ENNIS AND GEORGE FRANCIS MACDANIEL ENNIS,
Both of the Middle Temple, Esquires, Barristers-at-Law.
London: EFFINGHAM WILSON & CO., Royal Exchange.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
**See Advertisement p. IV., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.
J. C. CHAPMAN, C.E., Chartered Patent Agent, 70, Chancery Lane, LONDON.

LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

G. L. LAMBERT, 26, Alberta Terrace, Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for repairs at their Neepsend and Effingham Street Stations during the next Twelve Months.

Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered, by post, addressed to the undersigned, not later than Saturday, Nov. 4 next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Oct. 13, 1893.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

(INCORPORATED BY ACT OF PARLIAMENT.)

SALE OF SEVEN PER CENT. STOCK.

MESSRS. G. A. WILKINSON & SON (in conjunction with Messrs. Wilkinson, Son, and Welch, of Brighton) are instructed by the Directors of the Brighton and Hove General Gas Company to SELL BY AUCTION, at the Mart, Tokenhouse Yard, City, on Wednesday, Nov. 22, at Two precisely, £20,000 SEVEN PER CENT. "A" ORDINARY CONSOLIDATED STOCK of the above Company, in 200 Lots, being £100 Stock in each Lot. The Sale is made under the provisions of the Company's Act of 1893.

Particulars and Conditions of Sale, with a copy of the audited Accounts for 1892, may be had at the Company's Offices, 5, Great Winchester Street, Old Broad Street, LONDON, E.C., and 77, West Street, BRIGHTON; of Messrs. HOWLETT AND CLARKE, Solicitors, 8, Ship Street, BRIGHTON; of Mr. RALPH HOMAN, Stock and Share Broker, 2, Austin Friars, LONDON, E.C.; of Messrs. WILKINSON SON, AND WELCH, Auctioneers, 168, North Street, BRIGHTON; of Messrs. G. A. WILKINSON AND SON, Land Agents and Auctioneers, 7, Poultry, LONDON, E.C.

W. H. HARDY, Secretary.

Now Ready, Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS
OF THE
Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by
ALFRED LASS, F.C.A.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
190 and 191, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

JAMES WHITE & CO., LTD.,
WIDNES, LANCASHIRE,
Manufacturers of Special
FIRE-BRICKS,
FIRE-CLAY, &
FURNACE CEMENT.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best an most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

ANALYSIS AND REFERENCES ON APPLICATION.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1½ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-ON-TYNE.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,
15, HANOVER STREET,
EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·86 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

AUG. KLÖNNE,

DORTMUND (GERMANY).

REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy orking

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·123
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

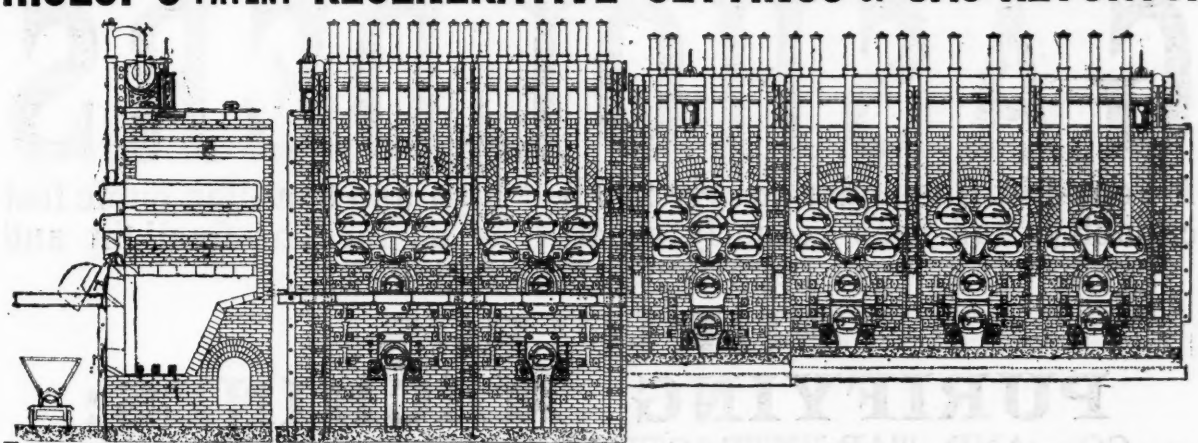
NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

G. WALLER & Co.'s NEW PATENT GAS EXHAUSTER
MADE WITH FOUR BLADES,
To pass 300,000 Cubic Feet per Hour, with or without Engine combined.
IN USE AND ON ORDER FOR OVER 100 WORKS,
AND EQUAL TO
5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—
The Four-Blade Exhauster **PASSES 50 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
It gives a steadier Gauge than any other Exhauster.
One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.
Model of Patent Exhauster sent for inspection.
Oldest Makers of Beale Exhausters for over 300 Works.
Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.
Washer-Scrubbers, with **WOOD CLUSTERS**, and Tar Extractor combined.

PHŒNIX ENGINEERING WORKS,
PARK STREET, SOUTHWARK, LONDON, S.E.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.
THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.
Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*
TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

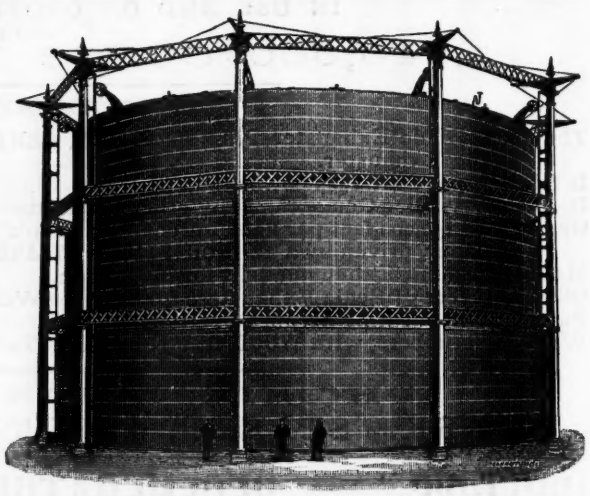
SPENT LIMES NO LONGER WASTE PRODUCTS
Under G. R. HISLOP'S PATENTS.
All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.
Descriptive Pamphlets and Terms from Agents as above.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

HANNA, DONALD, & WILSON,
(Established 1851),
GAS ENGINEERS & CONTRACTORS,
Abercorn Foundry and Abbey Works,
PAISLEY, N.B.,
MAKERS OF
Gasholders and Gas Plant
OF EVERY DESCRIPTION.
Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.
Telegraphic Address: "Donald Paisley."



GASHOLDERS
A Four-Lift Gasholder, nearly 200 feet high and 8 million cubic feet capacity, has been recently erected by us for The Gaslight and Coke Company, London.
PURIFIERS;
PURIFYING MACHINES;
CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;
SULPHATE & SULPHUR PLANT;
PATENT SELF-SEALING RETORT MOUTHPIECES;
LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;
SOLE MANUFACTURERS OF WECK'S PATENT CENTRE-VALVE.
PATENT TAR PLANT; CONDENSERS;
SLIDE-VALVES; TAR-BURNERS, &c., &c.
WOOD SIEVES.

C. & W. WALKER,
MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;
10, Finsbury Square, London.
"FORTRESS DONNINGTON, SALOP." "FORTRESS LONDON."—Telegraphic.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

CLAYTON SON & Co LTD

MAKERS OF

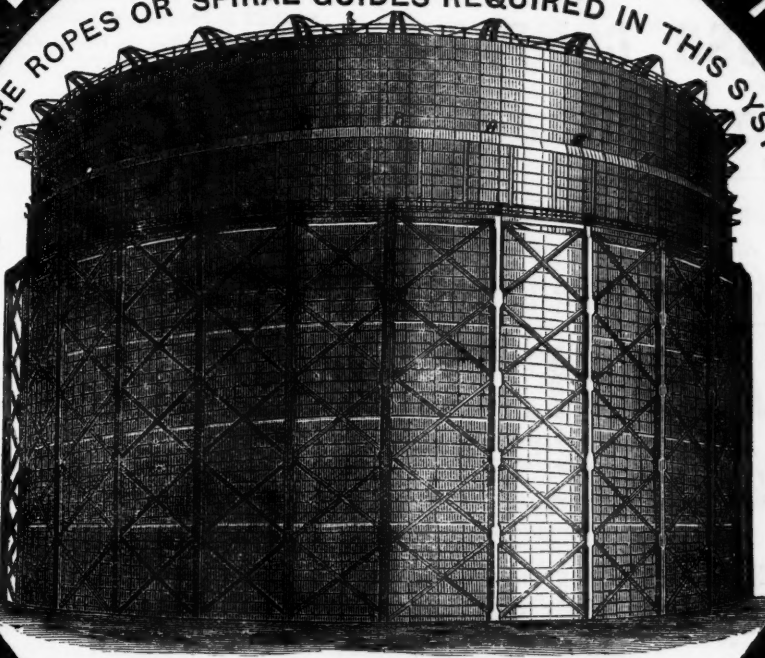
WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.



CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAR.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE
CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
OXO	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
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ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

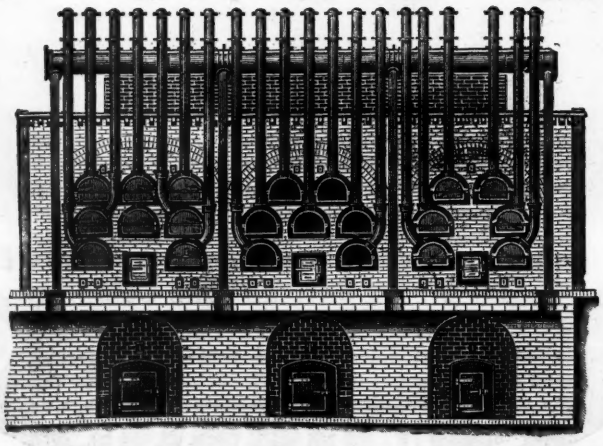
JONAS DRAKE & SON,

TELEGRAPHIC ADDRESSES
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON"

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S, VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

OVENDEN, HALIFAX.

R. & J. DEMPSTER,

GAS PLANT WORKS,

NEWTON HEATH, MANCHESTER.

Makers of every kind of Gas Apparatus and Structural Ironwork.

Sole Licensees of

SPIRAL-GUIDED GASHOLDERS,

WHEREBY COSTLY GUIDE-FRAMING IS DISPENSED WITH.

The following holders have been already erected, or are now in course of construction, upon this System :—

Two-Lift	60ft. 0in.	diam. by	20ft. 0in. deep.
„	40ft. 0in.	„	18ft. 0in. „
„	45ft. 0in.	„	10ft. 0in. „
Single-Lift, prepared for telescoping	50ft. 0in.	„	18ft. 0in. „
„ „ „	58ft. 0in.	„	20ft. 0in. „
„ „ „	80ft. 0in.	„	20ft. 0in. „
Single-Lift	16ft. 0in.	„	10ft. 0in. „
„	60ft. 0in.	„	18ft. 0in. „
Two-Lift	35ft. 0in.	„	12ft. 0in. „
Single-Lift	16ft. 0in.	„	15ft. 0in. „
Two-Lift	73ft. 0in.	„	24ft. 0in. „
„	79ft. 0in.	„	23ft. 4in. „
„	20ft. 0in.	„	10ft. 0in. „
Single-Lift	50ft. 0in.	„	14ft. 0in. „
Three-Lift	90ft. 0in.	„	20ft. 0in. „
Addition of third Lifts (two)	102ft. 0in.	„	28ft. 0in. „
Three-Lift	100ft. 0in.	„	24ft. 0in. „
Two-Lift	100ft. 0in.	„	30ft. 0in. „
„	50ft. 0in.	„	20ft. 0in. „
Single-Lift, prepared for telescoping	60ft. 0in.	„	20ft. 0in. „
„	60ft. 0in.	„	20ft. 0in. „
Addition of fourth Lift	124ft. 0in.	„	22ft. 0in. „
Single-Lift	80ft. 0in.	„	20ft. 0in. „
„ prepared for telescoping	74ft. 0in.	„	20ft. 0in. „
Two-Lift	39ft. 3in.	„	15ft. 6in. „
Three-Lift	115ft. 6in.	„	24ft. 0in. „
Single-Lift	72ft. 0in.	„	18ft. 0in. „
„	35ft. 0in.	„	12ft. 0in. „
Three-Lift	100ft. 0in.	„	24ft. 0in. „
„	132ft. 9in.	„	31ft. 0in. „

The reader's attention is invited to the fact that our position as Makers of SPIRAL-GUIDED GASHOLDERS THE SAFEST AND BEST of the several types of Columnless Gasholders, has not been modified by any recent adjustment of legal proceedings.

Telegraphic Address: "SCRUBBER MANCHESTER."

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

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GASEOUS FIRING
FOR LARGE OR SMALL
RETORT-SETTINGS
PLANS, SPECIFICATIONS,
AND ESTIMATES SUBMITTED.

SPECIALTIES

J. & H. ROBUS,
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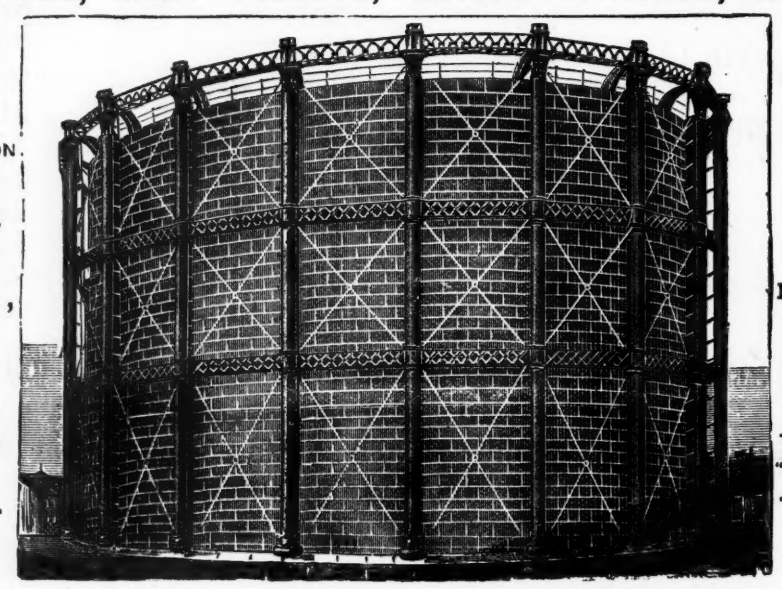
ENGINEERS & CONTRACTORS
FOR THE ERECTION OF GAS AND WATER WORKS
COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF GAS HOLDERS & GAS PLANT.

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS. VALVES,
PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF
STRUCTURAL IRON
AND STEEL WORK,
BRIDGES,
ROOFS,
PIERS, ETC.



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IRISH OXIDE OF IRON.

GAS PURIFICATION.

RIKY'S OXIDE (formerly worked by Messrs. Stanley and Olphert).

THE LARGEST SUPPLY OF OXIDE IN HAND OF ANY OTHER FIRM IN THE WORLD.

Purity and Uniformity of Quality Guaranteed.

RIKY AND Co. can supply the above at a much lower rate than any other firm in the trade, being owners of the property where it is found. *No Middleman* or *Agent* receives a profit.

SAMPLE AND PRICE ON APPLICATION.

Address **JOHN RIKY AND CO., Killygordon, County Donegal; and 193, Great Brunswick St., Dublin.** Telegrams: "RIKY, KILLYGORDON."

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MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

OSLER,

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MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

Gas-Bags for Mains. High-Water Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpauling Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber. Stokers' Gloves, 14s. per dozen.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

"TELEGRAPHIC ADDRESS" "GAS LEEDS."

CLAYTON, SON, & Co.

LIMITED,

LEEDS,

MAKE

RETORT LIDS

OF ALL FORMS AND SHAPES IN IRON OR STEEL

BY SPECIAL HYDRAULIC MACHINERY.

LONDON OFFICE: 60, QUEEN VICTORIA STREET, E.C.

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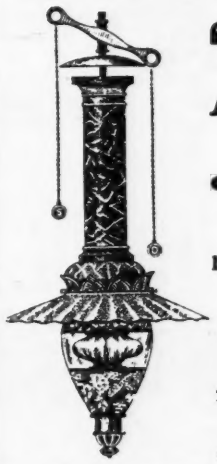
The Climax of Regenerative Gas Lighting!!



THE

"VERTMARCHE"

A 280-CANDLE POWER PLAIN IRON LAMP,

CLASS A— 55/-

LIGHT for LIGHT

less than half the price of any other Regenerative Lamp.

Manufactured in England by

HENRY GREENE & SONS,

153 & 155, CANNON STREET, LONDON BRIDGE, E.C.

PARTICULARS AND PRICES FREE. AGENTS WANTED.

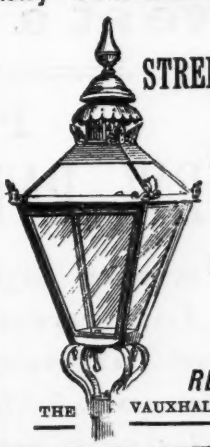
S. PONTIFEX & CO.,

GAS & WATER ENGINEERS,

22, COLEMAN ST., LONDON, E.C.,

Manufacturers of

STREET LAMPS for HOME & EXPORT.



ALL REQUISITES FOR STREET LIGHTING.

HIGH-POWER LANTERNS FOR REFUGES & OPEN SPACES.

IMPROVED STREET-LAMP REGULATORS AND LAMP TAPS.

THE VAUXHALL.

FLAT-FLAME GOVERNOR BURNERS,

Suitable for FACTORIES, OFFICES, and all Open Lights

at 15s. per dozen.

PATENT LAMPLIGHTERS' TORCHES.

COLUMNS for GAS or ELECTRIC LIGHTING.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

W. PARKINSON & CO.

STOVE DEPARTMENT.

TWO GOLD MEDALS.

DERBY, 1891.

WOLVERHAMPTON, 1891.

Several New Patterns are being introduced, combining those qualities for which we have so high a reputation.

FIRST-CLASS FINISH.

HIGHEST HEATING POWER.

ELEGANCE and ECONOMY.

THE "PARKINSON" GAS-FIRE.

Massive and Brilliant. 13-inch Fire Front.

A Grand Stove at a Very Moderate Price.

REGISTERED PATTERN.

PARKINSON'S NEW PATTERN GAS-FIRE FUEL

Is made by a Patent Process, and is an improvement on any Fuel of the kind hitherto made. It produces a Fire of intense heat and radiancy, and does not choke the flame.

Send for Parkinson's New Stove Catalogue.

COTTAGE LANE WORKS, CITY ROAD,	BELL BARN ROAD WORKS,	10, MAWSON'S CHAMBERS, DEANSGATE,
LONDON.	**BIRMINGHAM.**	**MANCHESTER.**
Telegraphic Address: "INDEX."	Telegraphic Address: "GAS-METERS."	Telegraphic Address: "PRECISION."

[See also Advt. p. 794.

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Oct. 31, 1893.